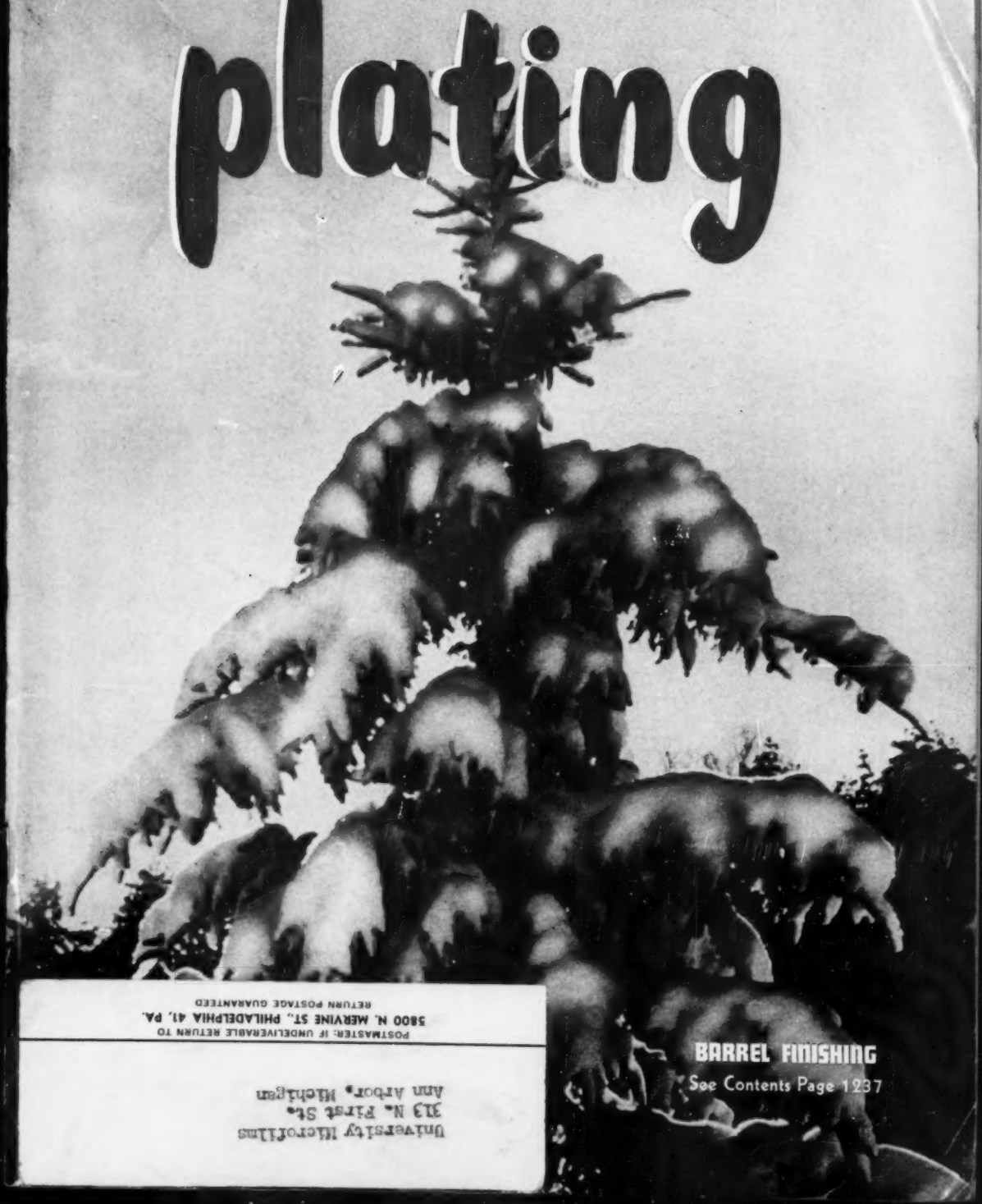
VOLUME 38
NUMBER 12

CHRISTMAS GREETINGS

DECEMBER, 1951

plating



BARREL FINISHING

See Contents Page 1237

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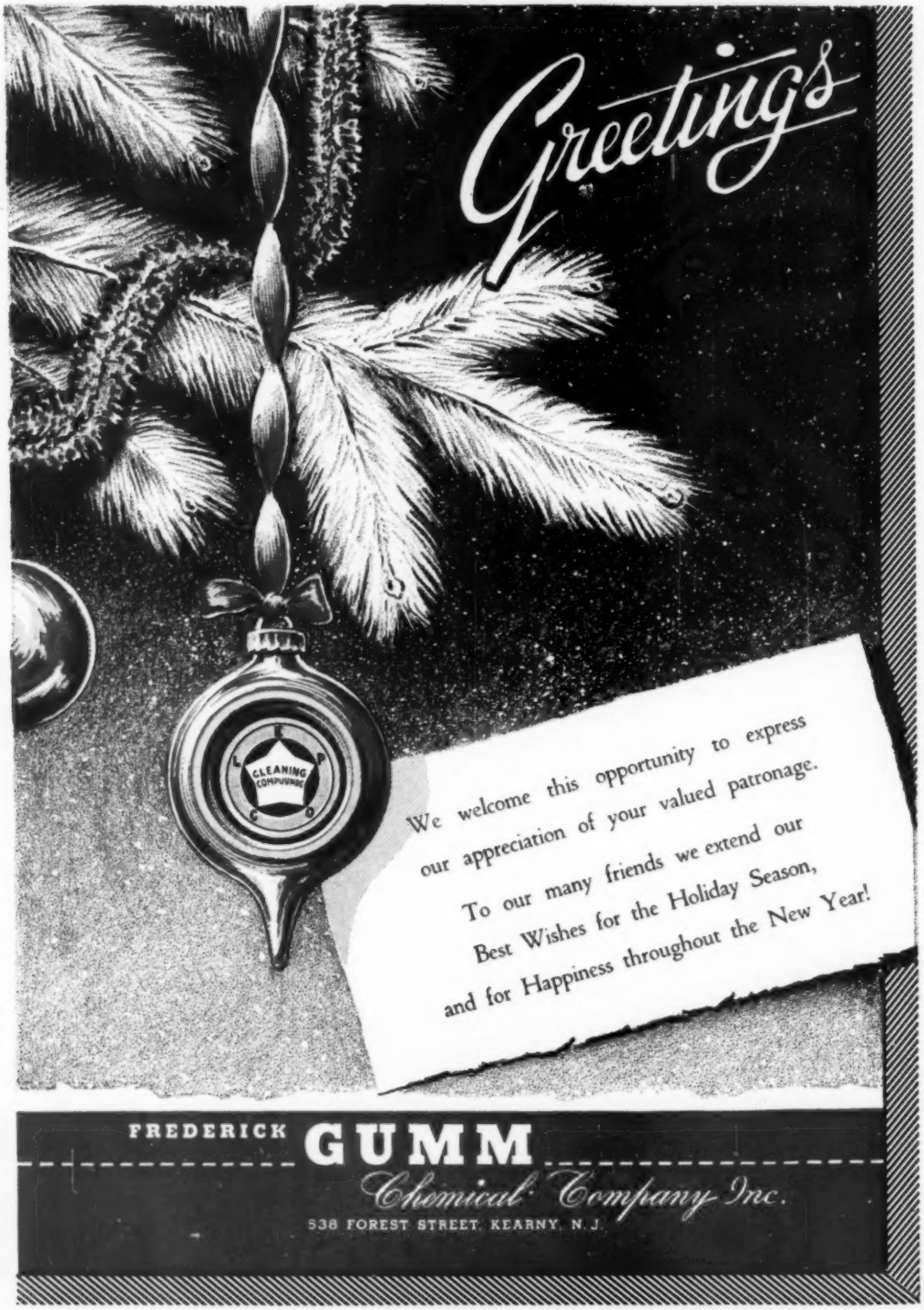

Greetings
CLEANING COMPOUNDS
We welcome this opportunity to express
our appreciation of your valued patronage.
To our many friends we extend our
Best Wishes for the Holiday Season,
and for Happiness throughout the New Year!
FREDERICK GUMM
Chemical Company Inc.
538 FOREST STREET, KEARNY, N. J.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1100.

Enthone metal strippers

no attack on the base metal

strip in barrels, baskets or bulk... without electric current

metal stripper A A new alkaline compound that chemically dissolves nickel, copper, zinc, cadmium and silver from steel without etching or attack. The steel is clean and ready for refinishing. Suitable for rack, basket or barrel stripping. Removes excess silver solder from steel rapidly. Patents pending.

metal stripper N-165S A compound added to acid solutions to promote rapid stripping of nickel, tin and lead coatings from copper alloys. No electric current is required.

WRITE FOR LIST OF SIXTY PRODUCTS AND PROCEDURES FOR METAL FINISHING

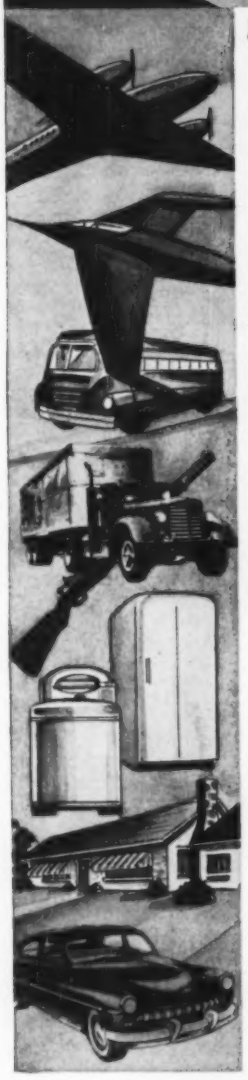
ENTHONE
INCORPORATED

442 ELM STREET • NEW HAVEN, CONN.

CHEMICALS
ACP
PROCESSES

phosphate coating chemicals

TO MAKE YOUR PRODUCT DURABLE



PAINT BONDING

"GRANODINE"® forms a zinc-iron phosphate-coating bond on sheet metal products—automobile bodies and fenders, refrigerator cabinets, etc.—for a durable, lustrous paint finish.

"LITHOFORM"® makes paint stick to galvanized iron and other zinc and cadmium surfaces.

"ALODINE",® the new ACP protective coating chemical for aluminum, anchors the paint finish and protects the metal.

RUST PROOFING

"PERMADINE",® a zinc phosphate coating chemical, forms on steel an oil-adsorptive coating which bonds rust-inhibiting oils such as "Granoleum."

"THERMOIL-GRANODINE"® a manganese-iron phosphate coating chemical, forms on steel a dense crystalline coating which, when oiled or painted, inhibits corrosion.

PROTECTION FOR FRICTION SURFACES

The oiled "THERMOIL-GRANODINE" coating on pistons, piston rings, cranks, camshafts and other rubbing parts, allows safe break-in operation, eliminates metal-to-metal contact, maintains lubrication and reduces the danger of scuffing, scoring, galling, welding and tearing.

IMPROVED DRAWING AND COLD FORMING

"GRANODRAW"® forms on pickled surfaces a tightly-bound adherent, zinc-iron phosphate coating which facilitates the cold mechanical deformation of steel, improves drawing, and lengthens die life.

Send for descriptive folders and Government specifications chart on the above chemicals. Write or call for more information on these products, and advice on your own metal-working problem.

Pioneering Research and Development Since 1914

AMERICAN CHEMICAL PAINT COMPANY

AMBLER, PA.

Manufacturers of Metallurgical, Agricultural and Pharmaceutical Chemicals

1206 FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1102.

Industry News

Bart-Messing Enlarges Belleville Plant. To insure prompt delivery of Sel-Rex Selenium Rectifiers, Bart-Messing Corporation has enlarged its manufacturing facilities at 229 Main Street, Belleville 9, N. J. The new area will provide for

more assembling and testing space. International distribution has been a factor in the increased demand necessitating the expansion.

Topper Equipment Company of Matawan, N. J., announces the purchase of Optimus Equipment Company patents, trade marks, manufacturing rights, sales rights, engineering drawings, as well as certain inventory and machinery pertaining to the vapor-degreasing business. This will include industrial vapor degreasers as well as automotive degreasers sold under the trade name of Circo, formerly manufactured by the Circo Products Company of Cleveland, Ohio.

The Topper Equipment Company, which will maintain warehouse stocks of trichlorethylene and perchlorethylene degreasing solvents in all major industrial areas, will occupy the same premises as did the Optimus Equipment Company, and most of the personnel will be retained. Mr. Morris, formerly the President of Optimus, is the President of Topper.

The **Optimus Equipment Company,** a subsidiary of the Hanson-Van Winkle Munning Company of Matawan, N. J., has discontinued operations and will be dissolved.

The Nutmeg Chrome Corporation has moved its office and factory to its new building at 111 Vanderbilt Ave., West Hartford 10, Conn.

Increased Sodium Silicate Production. Diamond Alkali Company, Cleveland, Ohio, today announced plans for an expansion of its silicate-of-soda plant at

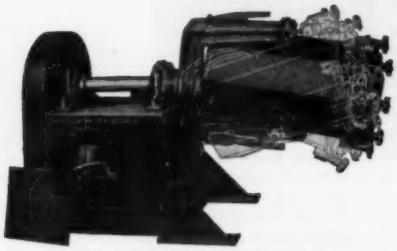
Published monthly at 5900 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Subscriptions: Domestic and Canada, $4.00 for 1 year, $7.00 for 2 years 50c per copy; Foreign, $8.00 per year, $1.00 per copy.

USE "RELIANCE" PRODUCTS FOR

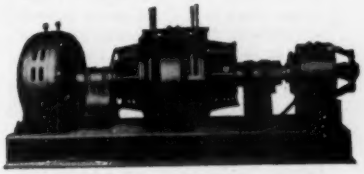
ECONOMY : EFFICIENCY : DEPENDABILITY

LET US SUPPLY YOUR NEEDS FOR YOUR PLATING OR POLISHING DEPARTMENT

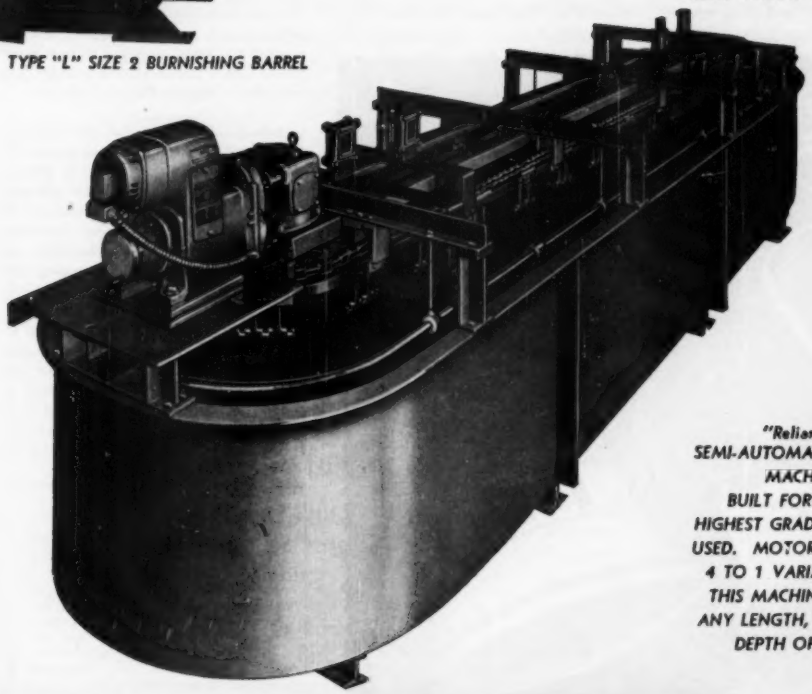
WRITE FOR FURTHER DETAILS



TYPE "L" SIZE 2 BURNISHING BARREL



3000 AMP. 6 VOLT GENERATOR SET



"Reliance"
SEMI-AUTOMATIC PLATING MACHINE
BUILT FOR SERVICE
HIGHEST GRADE MATERIAL USED. MOTOR ¾ to 1 HP
4 TO 1 VARIABLE SPEED.
THIS MACHINE IS BUILT ANY LENGTH, WIDTH AND DEPTH OF TANK.

Chas. F. L'Hommedieu & Sons Co.

MANUFACTURERS of

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Complete Plating Plants Installed

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Gen. Office and Factory:
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CHICAGO

Branches:
Cleveland
and
Los Angeles

Dallas, Tex., to meet the ever-growing demand in the booming Southwest.

The new project, estimated to cost several hundred thousand dollars, calls for the installation of a large furnace to supplement the production of three smaller furnaces now in operation.

The Dallas plant, one of Diamond's six silicate plants, was constructed as a one-furnace plant in 1941. A second furnace was added in 1945, a detergent plant was built in 1946, and the third furnace was placed in operation in 1948.

Udylite Exhibits Automatic Loader-Unloader. Visitors to the National Metal Exposition at Michigan State Fairgrounds, Detroit, October 15–19, saw a Junior Full Automatic hooked up to the new Automatic Loader, Unloader and Conveyor recently developed by The Udylite Corporation, Detroit 11, Mich. Visitors were shown how the device took racks of parts to be plated from the conveyor, moved them to the machine, and placed them on the machine. The Junior Automatic then took the racks through the plating cycle and returned them to the Automatic Loader, Unloader and Conveyor, which removed the racks and replaced them on their original hangars. The entire operation was automatic with no manual handling required. In addition, Udylite showed the latest model of its new barrel plater with a Lucite plating cylinder, and a small-size Rotary Full Automatic.

Arlington Corporation, 668–684 Jenks Ave., St. Paul 6, Minn., machine and tool-and-die builder, has released a 20-page brochure explaining the facilities and services of its plant for the manufacture of mixers for paints and other materials, serving trays, and special machines and parts. It has extensive stamping and plating facilities.

Electroplating in Preservation of U. S. Historic Documents. On September 17, 1951, the President and the Chief Justice of the United States participated in ceremonies at the Library of Congress in connection with the "sealing" of the **Declaration of Independence** and the

SALES REPRESENTATIVE

Situation Open—Salesman wanted for Chicago and Midwest territory by old established manufacturer of complete line of electroplating and polishing equipment and supplies. Excellent opportunity for experienced man. Our men are acquainted with this advertisement. State experience, age, education and salary expected.

Reply to:
P-1251-A, PLATING
P. O. Box 168, Jenkintown, Pa.

SITUATION WANTED

Research Director. Metallurgical chemist with broad experience in electroplating, metal finishing and corrosion work; seeks equivalent position. Reply to: P-1251-B, PLATING, P. O. Box 168, Jenkintown, Pa.

FOR PLATING STEEL

UNIQUE CLEANERS IMPROVE RESULTS—SAVE MONEY

Diversey No. 909 and No. 12 are two outstanding cleaners specially developed to provide superior finishes on steel surfaces through better, more thorough cleaning performance.

No. 909 and No. 12 are easily applied to a variety of different cleaning routines. No. 909 is a unique heavy duty soak tank cleaner. No. 12 is an electrocleaner for both direct and reverse current. The following case history is typical of the results you can expect through the application of Diversey No. 909 and No. 12.

TUBULAR STEEL FURNITURE CASE HISTORY

PROBLEM: To clean polished steel tubular furniture prior to bright nickel and chromium electroplating.

FORMER PROCESS: Included mineral spirits soak, handwipe, spray wash, alkaline soak and two electrocleaning operations. Six men, working steadily, were required.

PRESENT PROCESS: Includes Diversey No. 909 soak, and Diversey No. 12 reverse current electroclean.

RESULTS: The Diversey Process completely removes oil and grease from the inside of the tubes, avoiding contamination of pickle and nickel tanks as characterized the previous process. The cleaner tanks now are dumped every two weeks rather than every week as was formerly necessary. The No. 909 and No. 12 are the only materials this leading finishing plant has found that would eliminate the solvent and handwipe operations. The elimination of handwiping labor costs results in an estimated savings of $15,000.00 per year. A definite improvement in smoothness and luster of the electrodeposit resulted with Diversey No. 909.

COMPLETE INFORMATION AVAILABLE

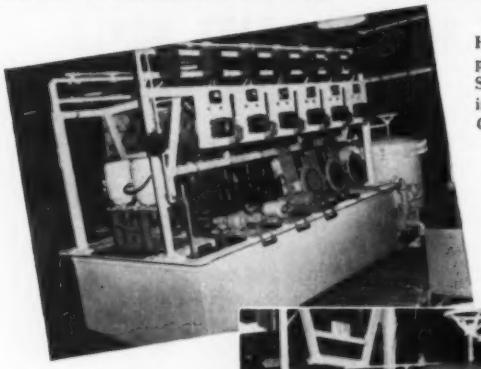
For additional information, including technical bulletins, write or call your Diversey D-Man. He will be pleased to work with you. Write or call today. *The Diversey Corporation, Metal Industries Department, 1820 Roscoe Street, Chicago 13, Illinois. In Canada: The Diversey Corporation (Canada) Ltd., Lakeshore Road, Port Credit, Ontario.*

Diversey

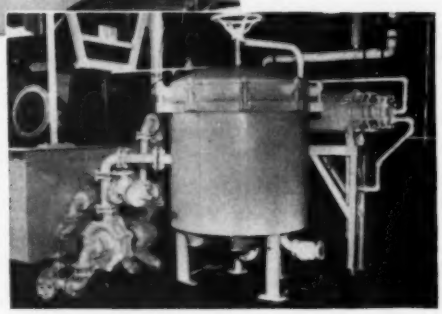
BETTER MUSIC

with an assist from

SPARKLER FILTERS



High-speed copper plating equipment and Sparkler filter installed in RCA Victor plant at Canonsburg, Pa.



Close-up of Sparkler installation with heat exchanger behind filter and pump and motor at left of filter.

Sparkler filters installed in the Radio Corporation of America's phonograph record plants are one of the reasons why all RCA Victor recordings so faithfully reproduce the tone and quality of the original sound.

Here's why: One of the initial steps in this manufacturing process is the production of a large number of molding dies. The first die is made by electroforming an exact negative of the original soft lacquer recording; then, other electroforming operations produce the additional dies needed.

Since the smoothness of the grooved surfaces is one of the factors that determine the amount of noise produced by the record when played, and since any foreign particles in the plating solutions will introduce roughness into the electroformed parts, it is obvious that extremely clean nickel and copper plating solutions must be obtained.

Sparkler handles this job easily, because the horizontal plate principle is especially designed to provide finest quality filtration under all types of operating conditions. Operators know that there is never any variation in quality with a Sparkler filter, even under fluctuating pressures or intermittent operation, since filter cakes are built up uniformly on horizontal plates. High flow rates, easy cleaning, complete portability, extremely low maintenance and operating costs, and minimum "down-time" — are other Sparkler features "tailor-made" for the plating industry.

Contact your Sparkler representative today, or write Mr. Eric Anderson for full information or engineering assistance.

SPARKLER MANUFACTURING COMPANY, Mundelein, Illinois

Sparkler International Corp.
Herengracht 568, Amsterdam, Holland

Sparkler Western Hemisphere Corp.
Mundelein, Ill., U.S.A.

Manufacturers of fine filtration equipment for more than a quarter of a century

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Industry News

Constitution in special glass-covered containers filled with helium. This project was planned and executed by the National Bureau of Standards, with the cooperation of the Libbey-Owens-Ford Glass Company. The methods used to safeguard these historic documents are described in NBS Circular 505, which may be purchased from the Superintendent of Documents for 15 cents.

Of special interest to electroplaters is the fact that the bronze frames were electroplated with gold by Vernon A. Lamb and August Zejda of the NBS Electrodeposition Section. These frames were coated with approximately 0.0003 inch of gold, equivalent to about 10 cents worth per square inch. To protect the frames during their handling and assembly, after being plated, they were coated with an air-drying acrylate lacquer by Mrs. Clara Sentel of the NBS Organic Coatings Section. It is believed that with these coatings the frames will be as permanent as the rest of the equipment used to protect these documents.

The New Social Security. The field offices of the Social Security Administration have free booklets available for distribution which explain the new social security: when you and your family or your survivors will become entitled to benefit payments and how to apply for them. They give you quickly the basic information you need about your rights and responsibilities under Federal Old-Age and Survivors Insurance.

If you work in employment or self-employment covered by the law, you will make social-security-tax contributions during your working years to provide an income for yourself and your family in case your earnings are cut off by old age or by death. If you are employed, you and your employer share the tax; if you are self-employed, the rate of your tax is 1½ times that of an employee who earns the same amount.

The amount of your monthly old-age insurance payment depends on your earnings in work covered by the law. The amount paid to other members of your family—to your wife, or to children under 18, for example—is figured from the amount of your old-age insurance benefit.

For additional details or for a free copy of the booklet mentioned above, contact your local Social Security field office.—SOCIAL SECURITY ADMINISTRATION, 18 W. Chelten Ave., Philadelphia 44, Pa.

The Electrodepositors' Technical Society announces that, in accordance with a resolution passed at the last Annual General Meeting, the Society has now become an incorporated body.

The Society has also changed its name and will be known as **The Institute of**

FULL LENGTH "CONDUCTA-CORE" INCREASES CONDUCTIVITY, RIGIDITY

Federated Conducta-Core Lead Anodes have a highly conductive and non-contaminating 3/8" diameter aluminum rod running from top to bottom. This, together with the unique design of the anode, assures complete rigidity . . . there is no curling, buckling or peeling to interfere with automatic plating operations.

The Conducta-Core makes every inch of the anode highly and uniformly conductive . . . more current can be carried than by ordinary anodes. Another advantage of the Conducta-Core Anode is the great number of high projections that give it greater-than-average throwing power.

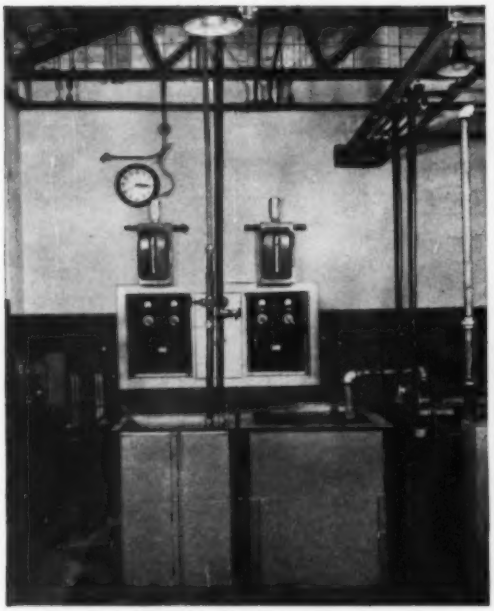
No need to worry about anodes dropping into the tank because of corroded hooks . . . an improved lead coating 3/16" thick at the base of the copper hook is your guarantee of permanently attached anodes.

Federated Conducta-Core Anodes are available in all standard lengths up to 52 inches, and with a variety of hooks. Special sizes made to order. Flat Rolled and 3-Rib Lead Anodes can also be supplied.

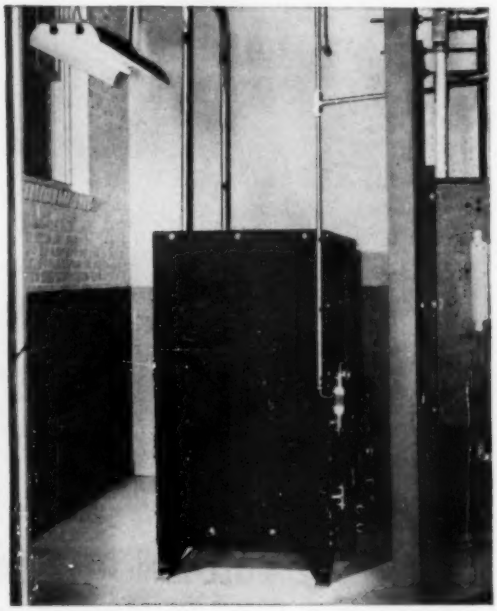
Federated Metals Division

AMERICAN SMELTING AND REFINING COMPANY • 120 BROADWAY, NEW YORK 5, N. Y.

More Years of Service with G-E Copper-Oxide Rectifiers



High Standard Manufacturing Corp. uses G-E copper-oxide plating rectifiers for anodizing aluminum die castings. Controls are set in the wall; rectifiers are in a separate adjoining space. This installation uses two sets of manual controls.



No corrosion problem here. Through ordinary care, these copper-oxide plating rectifiers will give long dependable service. Note the clean, airy surroundings. In addition these rectifiers will give longer service because of the sensible partitioning between rectifiers and plating room.

Like many other users, the High Standard Manufacturing Corp., New Haven, Connecticut, calls its G-E copper-oxide plating rectifiers "excellent." High Standard has had no maintenance on its G-E equipment beyond normal preventive care. This is partially due to the rectifier's location. Proper placement in clean surroundings means a longer lasting peak performance—continuous dependable service. Greater efficiency at plating currents and less change in characteristics with aging has made copper-oxide one of the most popular of all plating rectifiers. These two features mean lower power costs over more years of service.

G-E copper-oxide rectifiers are available with either automatic or manual control. For the ultimate in uniform plating, predictable plating costs and minimum labor, G.E.'s automatic system is your choice. For dependable plating current—with simple, convenient, "at-the-load" control which is moderate in initial cost—use G-E manually controlled copper-oxide rectifiers.

For complete details, write for Bulletin GEA-5247. *General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC

464-7

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1108.

Industry News

Metal Finishing incorporating Electrodepositors' Technical Society Limited. This is in accordance with the general policy of the Society, to extend its field beyond electrodeposition processes to include metal-finishing generally, with which the bulk of its members are vitally concerned. The original aims and objects of the Society—namely, to promote the study of, and disseminate information on, electrodeposition and cognate processes as widely as possible—are in no way affected.

The executive officers and council of the new Institute remain unchanged. The present officers are: Mr. H. Silman, B.Sc., F.R.I.C., A.M.I. Chem. E., F.I.M., President; Dr. S. Wernick, M.Sc., F.R.I.C., F.I.M., Honorary Secretary; and Mr. F. L. James, Honorary Treasurer.

Grieve-Hendry Company, Inc., 1101 N. Paulina Street, Chicago 22, Ill., manufacturer of industrial portable electric ovens, announces the appointment of **L. H. Butcher Company,** San Francisco, Portland, Seattle, and Salt Lake City, as its West Coast distributor to the plating and related metal-finishing industries.

The Instrument Society of America at its Sixth Annual Instrument Conference and Exhibit held in Houston, September 10–14, elected Dr. Arnold O. Beckman president. Richard Rimbach is the secretary of the Society.

The Houston meeting brought together 7,000 instrument engineers and mechanics, instrument manufacturers and suppliers, and top-flight scientific workers from all parts of the world. The 154 exhibiting companies, with 10 million dollars worth of instruments occupying 24,000 sq ft of exhibit space, represented the largest participation to date in this annual display.

The Suffern Plating Corporation, on September 1, moved its office and plant to modern and larger quarters at 199 Goffle Rd., Hawthorne, N. J. The capacity of this plant is substantially greater than that of the previous plant in Suffern, N. Y.

POSITION WANTED

Electrochemist, Ph. D. 15 years research and industrial experience in electrodeposition and metal finishing, thorough knowledge of all electroplating and electroforming processes seeks responsible position.

Reply to:

P-1251-C, PLATING
P.O. Box 168, Jenkintown, Pa.

BRIGHT FINISHING SYSTEM

SPARKLES

LIKE CHROME!

Leading manufacturers approve zinc plate and IRIDITE® *Bright to replace conventional chrome plating*

If your problem is finding the right finish to replace conventional chrome plating, follow the lead of prominent manufacturers of all types of products . . . switch to zinc plate and Iridite Bright.

Here's what you get when you use this chromate finishing system to replace conventional chrome plating.

SPARKLING BRIGHT APPEARANCE

The zinc plate and Iridite Bright system resembles chrome so closely that visual inspection can scarcely tell the difference! And, the brilliance *lasts.*

BETTER CORROSION PROTECTION

Yes, you actually get better protection with zinc plate and Iridite Bright than with chrome plating . . . up to twice the life under accelerated salt spray conditions! And, by applying a clear baking lacquer over the Iridite coating you can increase the abrasion resistance and lasting qualities of this bright finishing system, at the same time making possible a greater salt spray protection.

LOWER FINISHING COSTS

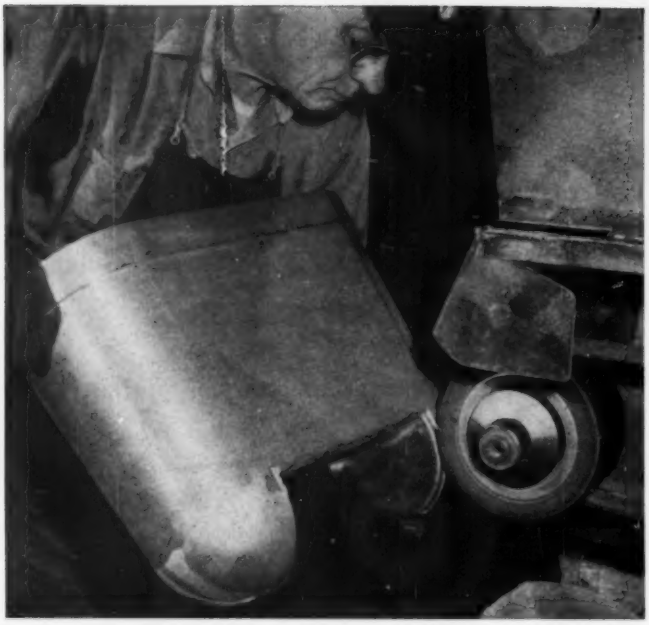
One metal, zinc, replaces three so you save material costs and plating time. Iridite Bright goes on in a non-electrolytic chemical dip.

Write or call today for your copy of our new Technical Bulletin describing all phases of this bright finishing system in detail. Tell us your bright finishing requirements. If possible send sample parts for test processing.

Iridite is approved under government specifications

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD

REPRESENTATIVES IN PRINCIPAL INDUSTRIAL CITIES; West Coast: L. H. BUTCHER COMPANY
Manufacturers of Iridite Finishes
for Corrosion Resistance and Paint Systems on Non-Ferrous Metals; ARP Plating Chemicals.



3M Belts cut costs Because They Last Longer

King Foundry, Minneapolis, reports 3M Abrasive Belts last 6 times longer than ordinary belts, resist loading on aluminum and brass castings.

No more production slow-downs for frequent belt-changing at King Foundry, Minneapolis! A 3M Methods Engineer recommended the *right* 3M Abrasive Belts for their job. Now operators report less loading—faster, smoother cutting, and belts are lasting 12 hours instead of 2 hours with previous abrasives. Production's up to 300 cast-aluminum housings per belt!

Cutting grinding and finishing costs is part of the day's job for the 3M Methods Engineer. And he's ready to go to work for you—at no cost, no obligation.

Use the coupon below for immediate attention. A copy of the booklet "Step Up Production" will show you how others have cut costs, increased production. Write today!

Minnesota Mining & Mfg. Co.,
Dept. P 121 St. Paul 6, Minn.

☐ Please have a 3M Methods Engineer call.

☐ Send a copy of "Step up Production."

Name .....

Company .....

Address .....

City ..... Zone ..... State .....

Made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn.—also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Adhesives. General Export: Minnesota Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N. Y.

In Canada: Minnesota Mining & Mfg. of Canada, Ltd., London, Canada.

Personals

Wallace MacMaster, Jr., has been appointed Direct Sales and Service Engineer for the plating and polishing trade in the Ohio area by the Williamsville Buff Division of The Bullard Clark Company,

MacMaster

Danielson, Conn. He is a graduate of the University of Pittsburgh, served in the U. S. Navy in World War II, and makes his home in East Cleveland, Ohio.

Donald A. King has joined Pennsylvania Salt Manufacturing Company's sales-service organization in the Industrial Chemicals Department and will make his headquarters in Detroit. A native of River Rouge, Mich., and resident of Wyandotte, Mich, he is a graduate of Michigan State College, where he earned his B.S. degree in chemistry. He is a member of the American Water Works Association.

C. M. (Bob) Fernekes, 125 Rexford Drive, East Grand Rapids, has been appointed Western Michigan representative of The Buckeye Products Company, Cincinnati, Ohio. Long a fixture in the Michigan territory, Mr. Fernekes will handle the Company's complete line of buffing and polishing compositions westward to Lake Michigan from a line extending south from Petosky through Lansing and Jackson to the Indiana border.

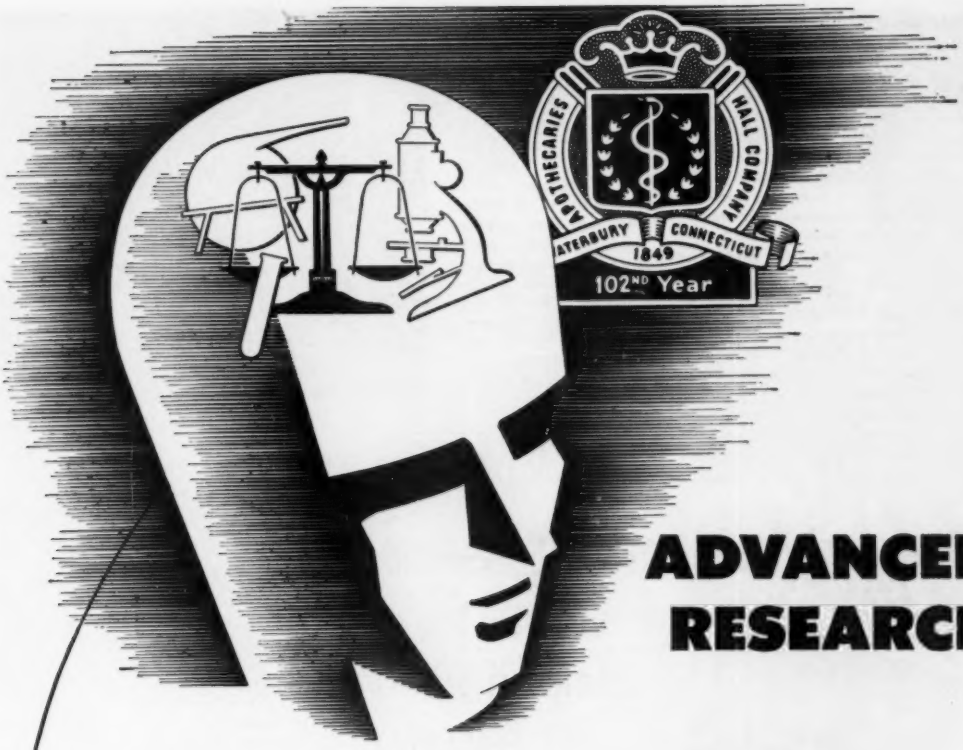
W. C. (Clark) Spruce, direct factory representative of the DeVilbiss Company's spray painting and finishing equipment division, has been promoted to Southwest District Manager. He will con-

CHEMICAL ENGINEER

Situation wanted. Young man, now working with a large supplier to the plating industry, desires a new connection in eastern United States. Experience includes analysis and testing of all types of plates and plating solutions and solution trouble shooting. Desire technical position in some phase of the metal finishing industry—preferably assistant to supervisor or process engineer.

Reply to:

P-1251-D, PLATING
P. O. Box 168, Jenkintown, Pa.



ADVANCED RESEARCH

for new materials, new methods . . . even better AHCO finishing products

New and improved metal products mean constantly changing requirements for cleaning, buffing and plating. Leadership in the manufacture of cleaners, buffing compounds, and nickel anodes is determined by the ability to stay ahead of immediate demand through advanced chemical research. Today Apothecaries Hall Company chemists, working far beyond the range of present needs, are developing the new finishing materials and methods that will make your metal products look better and sell better . . . tomorrow, next week, and next year.

Have you taken advantage of AHCO's free engineering and analytical services? Let our trained representatives help you set up that new finishing room; let our chemists analyze the finishing chemicals you are now using . there is no obligation.

For better finishing products, equipment, and know-how write today to Apothecaries Hall Company, Waterbury 88, Conn.

Over a Century of Service

APOTHECARIES HALL CO.

WATERBURY 88 CONN.

Personals

tinue to maintain offices at the DeVilbiss Company's branch, 1515 Dragon St., Dallas, and will supervise the company's sales activities in the newly created Southwest District which includes Texas, Louisiana, Mississippi, Arkansas, Oklahoma, New Mexico, a section of western Tennessee and northwestern Alabama.

Mr. Spruce has been associated with the DeVilbiss Company for more than 32 years.

J. P. Young, Columbus; **F. A. MacKercher,** Grand Rapids; **J. L. Worth,** Baltimore; **J. F. Pieper,** Omaha; **Tom McCormick,** Detroit; and **H. E. Moyer,** Philadelphia, all Wyandotte Chemical Corporation sales and service supervisors, were recently awarded gold watches. The presentation took place at a banquet in their honor at Wyandotte, Mich., attended by over 600 people.

Shown left to right, are: Seated—J. P. Young, F. A. MacKercher, J. L. Worth, and J. F. Pieper. Standing—Tom McCormick, Fred Tholen, Assistant General Sales Manager; Robert L. Reeves, General Manager, J. B. Ford Division; and H. E. Moyer

Wyandotte Sales and Service Supervisors

Messrs. MacKercher and Moyer recently retired under the company's pension plan.

Thomas A. Trumbour, General Manager of Finishing Publications, Inc., New York, publishers of "Metal Finishing" and "Organic Finishing", was recently honored on the completion of 50 years of continuous service by the presentation by Ass't. Publisher P. H. Langdon, of a defense bond and silver bowl appropriately inscribed recording the occasion.

Mr. Trumbour, who is a resident of Hawthorne, N. J., started with the firm in 1901, working on the "Aluminum World", one of the earliest trade magazines in the metal field, which later became "Metal Industry" and still later the present "Metal Finishing". During his period of service Mr. Trumbour has become one of the best known and liked men in his industry, and has attended 38 consecutive conventions of the American Electroplaters' Society.

Thomas F. Barron, veteran MacDermid, Incorporated, salesman, for the Providence territory, retired on October 1 after almost 55 years of active service in the finishing field.

Born on November 6, 1880, he began

Yours...FOR THE ASKING

Helpful Ideas on Barrel Finishing of All Types

Here's a twelve-page, highlight condensation of up-to-date ideas on the finishing operations that can be carried out in barrels . . . deburring, descaling, burnishing, rolling and tumbling.

You will find it helpful in sizing up your present barrel finishing setup, of course. And it will probably give you some ideas on replacing inefficient and costly manual operations with bulk finishing procedures.

It covers each kind of barrel finishing operation—types of barrels available—kinds of abrasives to use—suggested time cycles, etc.—as well as recommendations on Magnus Burnishing Compounds, Deburring and Descaling Cleaners for various types of operations.

Ask for as many copies as your department can use

MAGNUS CHEMICAL CO. • 41 South Ave., Garwood, N. J.
In Canada — Magnus Chemicals, Ltd., Montreal.
Service representatives in principal cities.

Magnus
CLEANERS • EQUIPMENT • METHODS

"Putting Mettle into Metals Since 1896"

BELMONT

METALS

Metals are our business—and yours too! Today our common problem is the shortage of all metals—the pressure of the civilian economy and defense demands is more than available supply can stand . . . up to the minute "know how" and time tested experience is more important than ever.

Better than half century of service and growth in all periods—War, Peace, "National Emergencies"—have "experienced" Belmont to cope with the current perplexities and problems. When that shortage strikes—or you wish to compare the merits of a substitute—contact Belmont . . . No effort will be spared to add Belmont experience and "know how" to yours—and that "probable" bottleneck can be smashed before it becomes serious.

"Belmont Metal of the Month" letters include market trends, statistics, and other helpful data—write to receive your copy—with our compliments.

Belmont SMELTING & REFINING WORKS, INC.

306 BELMONT AVENUE, BROOKLYN 7, NEW YORK • Dickens 2-4900

On any burnishing problem

DEPEND on DU-LITE for a Sparkling Finish

Courtesy Bevin Bros. Mfg. Co.

After tumbling with an ordinary compound, these kids' bicycle bells came out a dull lifeless gray. Substituting Du-Lite's #3 Burnishing Compound completely removed the gray soapy film, and gave the bells a bright mirror finish at a substantial saving of compound per month.

What's YOUR problem?

Du-Lite's service to industry is complete from research on specific metal finishing problems to installation of processing equipment. Du-Lite's line includes cleaners, strippers, blacking agents, wetting agents, passivating agents, rust preventatives, burnishing compounds etc. for any type of metal.

See your nearest Du-Lite Field Engineer or write for more information.

DU-LITE CHEMICAL CORP.
MIDDLETOWN, CONN.

Rush information on your products for finishing following metals:

Aluminum..... Steel..... Stainless Steel.....
Brass..... Copper..... Zinc.....
Others.....
Name.....
Company.....
Address.....
City..... Zone..... State.....

Du-Lite
METAL FINISHING SPECIALISTS

Personals

working at the age of 16 for the J. P. Bonett Company, of North Attleboro, Mass., as a scratch-brush operator. After several different jobs in the jewelry industry, he was Superintendent of an Attleboro jewelry plant until it was forced to close due to World War I.

Barron

In 1917, Barron started selling chemicals to the plating industry. He joined the Hanson-Van Winkle-Munning Company in 1922, and when George L. Claftin Company took over distributorship for Hanson he joined that organization.

In February, 1932, he started with MacDermid, Inc. of Waterbury, Conn. Here he consistently exceeded his annual sales quota and installed 96 bright-nickel and bright-copper solutions in the Providence area. Whereas the company's retirement age is 65, in Barron's case it was extended to 70 because of his excellent health. During the annual MacDermid sales meeting, he was honored at a banquet and presented with a matched set of luggage.

His many friends in the industry join in wishing him health and happiness in his retirement.

Don E. Weaver has joined the Metal Cleaner Department of Cowles Chemical Company as Technical Man in the Indiana-Southern Ohio territory.

Weaver

Having attended Ohio State University and the University of Cincinnati, he entered the stove-manufacturing field, and has been connected with firms in Ohio and New York State doing enamel-and-pickle-control work and supervising metal cleaning prior to porcelain enameling.

Harry Pochapsky has been promoted from Senior Electrochemist to Chief Electrochemist of the Cleveland Graphite Bronze Company, Cleveland, Ohio. He

Available for Immediate Shipment, Attractive Values

PLATERS

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

1—7500/3750 AMPERE, 6/12 VOLT **A. P. MUNNING** "OPTIMUS." Separately Excited.

1—6000 AMPERE, 2/6 VOLT **JANTZ & LEIST.** Separately Excited.

1—6000/3000 AMPERE, 6/12 VOLT **BOGUE.** Synchronous Motor, Separately Excited.

1—5000/2500 AMPERE, 6/12 VOLT **HANSON-VAN WINKLE-MUNNING CO.** Synchronous Motor, Exciter-in-Head.

1—5000/2500 AMPERE, 6/12 VOLT **EAGER ELECTRIC CO.** Separately Excited.

1—2000/1000 AMPERE, 6/12 VOLT, **A. P. MUNNING** "OPTIMUS."

1—2000/1000 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Synchronous Motor, Exciter-in-Head.

1—1500/750 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.**

1—1500/750 AMPERE, 12/24 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Synchronous Motor, Exciter-in-Head.

1—1000/500 AMPERE, 6/12 VOLT, **CHANDEYSSON ELECTRIC CO.** Synchronous Motor, Exciter-in-Head.

ANODIZERS

1—4000 AMPERE, 40 VOLT, **CHANDEYSSON** ANODIZER. Synchronous Motor, Exciter-in-Head. Full automatic controls.

2—1000 AMPERE, 30 VOLT, **IDEAL** ANODIZERS. Exciter-in-Head.

1—1000 AMPERE, 40 VOLT, **CHANDEYSSON** ANODIZER. Synchronous Motor, Exciter-in-Head.

1—500 AMPERE, 40 VOLT, **"M. G. C."** ANODIZER. Exciter-in-Head.

1—400 AMPERE, 40 VOLT, **"M. G. C."** ANODIZER. Exciter-in-Head.

1—500 AMPERE, 25 VOLT, **CHANDEYSSON** 25 DEG. ANODIZER. Synchronous Motor, Exciter-in-Head.

RECTIFIERS

5—**GREEN ELECTROPLATERS,** 1800 AMPERE, 12 VOLT, for 220/3/60 A.C.

1—**GENERAL ELECTRIC CO.** COPPER OXIDE RECTIFIER, 2000 AMPERE, 6 VOLT, for 220/3/60 A.C.

2—**UDYLITE-MALLORY** RECTIFIERS, 1440/720 AMPERE, 6/12 VOLT, for 220/440/3/60 A.C.

4—**GENERAL ELECTRIC** COPPER OXIDE RECTIFIERS, 500 AMPERE, 6 VOLT, for 220/3/60 A.C.

SPECIAL

2—No. 101 PRODUCTION PIPE POLISHING MACHINES.

PHONE, WRITE, WIRE

M. E. BAKER CO.

25 WHEELER STREET

Kirkland 7-5460 CAMBRIDGE 38, MASS.

PLATEMANSHIP

H-VW-M's unique combination of:

. . . the most modern and complete laboratory for testing and development

. . . ability to provide complete equipment and materials for every plating and polishing need

. . . the complete background of knowledge and experience in every aspect of plating and polishing.

ONLY H-VW-M AND *PLATEMANSHIP* PUT AS MANY EXTRAS IN COMPOSITIONS

. . . more mileage per pound of composition

. . . adherence to the wheel as long as the abrasive retains its cutting action

. . . maximum color per degree of cut

. . . clean working properties

. . . easy solubility in cleaning solutions

H-VW-M has worked long and closely with the plating and polishing industry in developing compositions which are exactly right for the job. Years of research, experiment and development have resulted in the ability to supply compositions of all grades for all purposes . . . resulted in H-VW-M *Platemanship*. The complete line consists of a variety of job-fitted forms for convenient application by hand or automatically in either bar or liquid and to provide maximum buffing efficiency and economy.

Platemanship—H-VW-M's often proved ability to meet every need of the plating and polishing industry—is your assurance of getting compositions which meet your requirements exactly. And —H-VW-M, through complete laboratory facilities, is in position to develop special compounds for unusual operating conditions. Bulletin BC-104 describes the complete range of H-VW-M Compositions. Send for it.

HANSON-VAN WINKLE-MUNNING COMPANY, MATAWAN, NEW JERSEY

PLANTS AT: MATAWAN, N. J. • ANDERSON, INDIANA • *SALES OFFICES:* ANDERSON • BOSTON • CHICAGO CLEVELAND • DAYTON • DETROIT • GRAND RAPIDS • MATAWAN • MILWAUKEE • NEW HAVEN NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SPRINGFIELD (MASS.) • STRATFORD (CONN.) • UTICA

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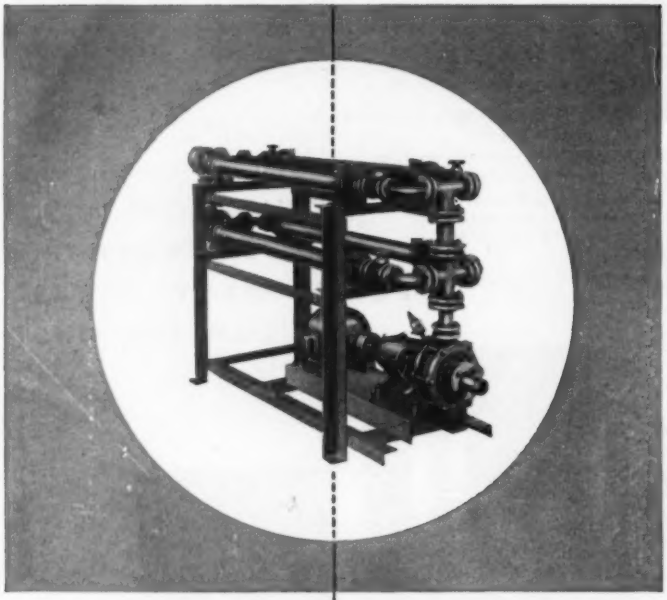


A highly corrosion resistant heat exchanger in a READILY AVAILABLE ALLOY*

The **DURCO** No. 4-A Heat Exchanger efficiently heats or cools corrosive plating solutions.

In this exchanger, the corrosive is in contact only with Duriron parts. The units can be installed either horizontally or vertically, with counter or parallel flow, and permit flexibility of grouping for difficult locations.

***DURIRON** is a high silicon iron, resistant to most commercial acids and other corrosives such as nickel plating, copper plating, chrome plating and anodizing solutions.

Cross section view of Durco No. 4-A Heat Exchanger

DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

We will send, on request, Bulletin 1610B giving complete details and specifications.

THE DURIRON COMPANY, Inc.
Box 1019, Dayton, Ohio

Personals

is known for his work on the electrodeposition of bearing metals, and is Secretary-Treasurer of the Cleveland Branch of the American Electroplaters' Society.

Ezra A. Blount, Editor of Products Finishing and Past President of the Cincinnati Branch, A. E. S., is now serving as Lt. Col. with the U. S. Air Forces in Tokyo, Japan.

Dr. Paul G. Agnew, administrative head of American Standards Association from its founding in 1919 until his retirement to consultant status in 1947, who was 70 in July, received the first annual gold Standards Medal of the Association at the Second National Standardization Conference held in New York on October 22–24.

Before 1919 he served for 13 years as a physicist with National Bureau of Standards. He received a Ph.D. degree in physics at Johns Hopkins in 1911.

During his 28 years in office, the Association's staff grew from 3 to 70 persons, and its membership grew from 5 engineering societies to a federation of some 100 National trade associations, technical societies and consumer organizations. Today there are 1,215 American Standards.

Obituaries

✠ **John Walker,** head of the Rapid Plating Works, Toronto, Canada, for 30 years passed away suddenly in the East General Hospital on Monday, June 11, 1951.

He was well known in the plating business, a member for more than 25 years of the American Electroplaters' Society and a past president of its Toronto Branch. Two sons, Donald and Gerald, follow in their father's footsteps by carrying on the business.

✠ **Lloyd S. Williams,** President and General Manager of Armalite Company Limited, Toronto, Canada, passed away suddenly at Toronto on Sunday, July 29, 1951, after a week's illness. His age was only 31.

A leading figure in the electroplating and metal finishing field in Canada, he was well known to many in the U. S. A. and a past president of the Toronto Branch of the American Electroplaters' Society.

In 1944 he graduated from Queen's University as a Chemical Engineer and won two scholarships. From 1944 to 1951 he was engaged in the research and development of electroplating. Although his career was short, his loss is greatly felt by the entire industry.

Besides his wife Joyce and two children, Barbara and Robbie, he leaves mourning a host of friends throughout the country. His memory will remain.

ROHCO

At this Holiday Season we count with gratitude the blessings of old friendships and new.

To the Platers of America we extend our heartfelt wishes for a very Merry Christmas and a Happy and Prosperous New Year!

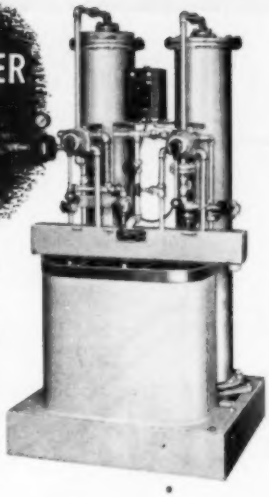
R. O. HULL & COMPANY, INC.

1302 Parsons Court • Rocky River 16, Ohio

ROHCO 100 BARREL ZINC BRIGHTENER • ROHCO 303 STILL ZINC BRIGHTENER • ROHCO 20XL CADMIUM BRIGHTENER • ROHCO IMPERIAL SILVER BRIGHTENER • FORCITE ANODE BASKETS • NO-CRO-MIST® FOR CHROMIUM BATHS • HULL CELL TEST SETS AND RECTIFIER UNITS

CHEMICALLY PURE WATER *is Cheap*

only a few cents a thousand gallons



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Water Demineralizers

A two-bed INDUSTRIAL demineralizer unit. Standard units are available with capacities of 200 to 1000 gph. Special units of any capacity are engineered to requirements.

Eliminate UNWANTED PRECIPITATES
HOT WATER RINSE STAINS

These two difficulties in plating can be eliminated with one stroke—chemically pure water. Pure water in plating solutions improves the over-all quality of plated coatings. The use of pure water for hot rinses prevents stains and water marks after drying. With an INDUSTRIAL demineralizer chemically pure water costs so little that the unit pays for itself in a short time. It's easy to install and operate, and requires very little floor space.

Write for Bulletin 200
or send us a water analysis, letting us know the amount of treated water required in gallons per hour, and whether intermittent or continuous flow is needed. We will then give you the whole demineralizer story, including estimated cost, equipment required, performance data, etc. for your requirements.

for solution clarification . . .

INDUSTRIAL Filters

A typical INDUSTRIAL stationary filter. Standard portable and stationary models are available with capacities 100 to 15,000 gph. Special filtering systems are engineered to meet unusual requirements.

Write for Full Information and Recommendations

FILTERS Pressure Type · PUMPS Centrifugal · CORROSION TESTING APPARATUS Salt Fog • Humidity

INDUSTRIAL FILTER & PUMP MFG. CO.

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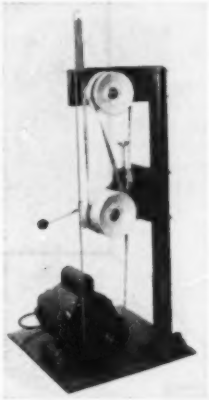
RUBBER DIVISION Vulcanized Linings • Molded Products · WATER DEMINERALIZERS

Trade Literature

L—698. Metal Protective and Paint Bonding Chemicals and Processes—American Chemical Paint Company, Ambler, Pa., offers a revised edition of its 8-page "Quick Reference List". It indexes by metal a variety of cleaning, pickling, brightening and coating treatments, describes each and its applications, and lists applicable Government Specifications. For your copy, use Reader Service Card.

L—699. Belt Polishing—Behr-Manning Corporation, Troy, N. Y., Division of Norton Company, announces the development of a coated-abrasive-belt sanding unit especially designed for inside diameter sanding, grinding and polishing



work. Described in detail in Products Engineering Bulletin No. 10, it is adaptable to either free-running or platen-backed coated-abrasive-belt operations, and has proved successful on such items as bomb straps, horn rings, gas-tank necks, tin

snips and heavy shear rings. Called the Tongue Sander, it is not manufactured or sold by Behr-Manning but can be easily assembled from standard parts. For your copy of the bulletin, use Reader Service Card.

L—700. Steel Cleaning—Oakite Products, Inc., 140 Thames St., New York 6, N. Y., has announced a 28-page illustrated booklet, "Four Good Steps Toward Better

Burnishes Better and FASTER

Features

Patented bearing construction assures smooth running — No vibration even with capacity load.

Direct Drive — No belts. Gears fully enclosed.

Motor mounted on top, out of the way — Stays dry — Easily accessible.

Accurately balanced for easy tilting.

Self-sealing cover of light-weight aluminum.

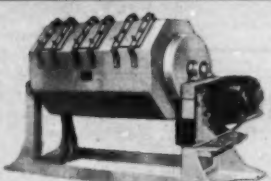
Spring-pressure ratchet lock, released by handy foot lever, holds barrel securely at any angle.

Hard maple lining — easily removable.

Three standard sizes.

DEBURRING BARRELS

3 - compartment barrel can be used for three different deburring jobs at one time. This model is also available with 1, 2 or 4 compartments.



Triple-Action Deburring Barrel for very fast cutting. Specially shaped sides greatly increase tumbling action and reduce deburring time. Ideal for removing heavy burrs and smoothing extremely rough surfaces.

SAWDUST DRYING BARREL

Combination Steam-Heated Sawdust Barrel and Separator. The winning combination for maximum efficiency. Dries the work quickly, leaving it bright and spotless, and separates it from the sawdust without handling.

BELKE *Better-Built* BURNISHING BARRELS

The Modern Low-Cost Method of burnishing stampings, die castings, machined parts and other small pieces. Produces more uniform work with less rejects, and requires less space and labor.

Heavy, welded-steel frame and base affords absolute rigidity. Will not warp or twist when used on rough or uneven floors. There are no protruding feet or braces to interfere with the operator. Patented radial and thrust bearing construction assures that the balls always run in a perfect race regardless of the position of the barrel, providing smooth, long wearing operation.

Write for additional information today or ask to have a BELKE Engineer call and help you select the proper barrel and tumbling compound to do your job most efficiently.

Belke

MANUFACTURING CO.

947 North Cicero Ave. • Chicago 51, Ill.

EVERYTHING FOR PLATING PLANTS

Christmas Comes But Once a Year . . .

But when it does, we get to feeling mighty unimportant. So here's a quiet "Thanks . . . and the best of everything in the year ahead" to our friends in the plating industry. Rapid Electric Company, *Rectifiers and Controls.*

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1121.

EXPECT THE BEST FROM TRUE BRITE

TRUE BRITE can now help your shortages of copper cyanide by concentrated solution of the double salts of sodium cyanide and copper cyanide. Reasonable prices and good materials are assured. Immediate delivery not assured, but attention will be given requests for information.

We also expect to have TRUE BRITE BRASS MAINTENANCE COMPOUND available in a concentrated liquid form and Makeup solutions for conventional brass plating. Write for information.

We still manufacture TRUE BRITE NICKEL BRIGHTENER and have plenty for immediate shipment. Still the best and most suited for subsequent chromium plating.

The TRUE INSULATOR is your best bet to insulate your steam and water lines from stray currents. Now available in ½, ¾, 1 and 1¼ inch sizes. Prompt delivery.

TRUE BRITE CHEMICAL PRODUCTS CO.

P. O. Box 31, Oakville, Conn.

Practical Products for Practical People

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1122.

Trade Literature

Electroplating on Steel", giving specific recommendations for effecting improvements in the average cycle for cleaning steel before electroplating.

Booklet lists in detail the benefits to be gained by: (1) precleaning more thoroughly—because the electrocleaning tank operates more economically and more effectively when the heavy oils and greases are removed by precleaning; (2) rinsing more thoroughly—because inadequate rinsing is the recognized cause of a large portion of plating difficulties; (3) using reverse-current cleaning for all electrocleaning of steel—because it does a more thorough job of removing the films that interfere with the adhesion of electrodeposited metals; and (4) using an efficient electrocleaner that provides high conductivity, superior smut removal, long solution life and other advantages.

Also of interest to platers are the answers presented in the booklet to such questions as: How can cleaning costs be reduced 33 per cent while plating quality is being improved? What are four easy ways to improve the average rinse tank? What rinsing fault invites trouble in the plating of high-carbon steel? How can an ordinary electrocleaning cycle be transformed into an exceptionally good cycle? For your copy, use Reader Service Card.

L—701. Phosphate Treatment—A circular, Form 1297, "Wyandotte Pre-Fos Protects Steel", issued by Technical Service Department, J. B. Ford Division, Wyandotte Chemicals Corporation, Wyandotte, Mich., contains four actual samples of protected and unprotected in-process steel. Wyandotte Pre-Fos is said to be a triple-action material that cleans, deposits a fine-grained phosphate coating, and prevents rust. Technical information concerning the processing of steel sheets is given. Data supporting the manufacturer's claim of greatly increased life for Pre-Fos-treated and painted metal products are also contained in the pocket-sized folder. For your copy, use Reader Service Card.

L—702. Rectifiers, P-R Equipment—Rapid Electric Company, 2881 Middletown Rd., New York 61, N. Y., offers a Bulletin RP-51 which describes and illustrates a variety of selenium rectifiers, periodic-reverse-current equipment, remote and automatic controls, and accessories. Dimensions of stock models are given, as are explanatory notes about the workings of the equipment. For your copy, use Reader Service Card.

L—703. Buffing and Polishing Compositions—A large illustrated Bulletin C-100 has been issued by Hanson-Van Winkle-Munning Company. It covers bobbing composition, crocus compositions,

SAVE PRECIOUS METAL WITH SCHAFFNER

Save UP TO 65% OF YOUR PRECIOUS Nickel

by Using Schaffner's

New Laboratory Developed

PRODUCTION PROVEN

STEEL BUFFING COMPOUNDS

LET US PROVE THESE CLAIMS IN YOUR OWN PLANT!

Nickel is too scarce nowadays to buff off with old fashioned buffing compounds and methods.

Schaffner's saw this day of scarcity coming and got ready for it. Five years ago we began research and development of a "masterpiece" buffing compound that would spare the metal while perfecting the finish.

That new-type compound is at last perfected. It is daily proving itself on industry's important metal finishing assembly lines all over America.

Put Schaffner's new *Steel Buffing Compound* to work for you — saving you time, saving you precious nickel, selling and preserving your product. Write, wire or phone ROSEWOOD 1-9902 *today* for the complete story — and you'll put this product to work for you *tomorrow*.

Send for this Catalog today!

"Schaffner Bros. make things shine"
Bob — Paul — Gus

Schaffner

MANUFACTURING COMPANY, INC.

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* TRIPOLI COMPOUNDS * CHROME COLORING ROUGE * GREEN ROUGE * JEWELERS' ROUGE * CROCUS COMPOUND * STAINLESS STEEL COMPOUNDS * ALUMINUM BUFFING COMPOUNDS * ALL-PURPOSE BUFFING COMPOUNDS * WHITE COLORING COMPOUNDS * NICKEL BUFFING (LIME) * EMERY CAKE * PLASTIC BUFFING COMPOUNDS * TALLOW GREASE STICK * PUMICE GREASE STOCK * POLISHING WHEEL CEMENT * STEEL POLISHING COMPOUNDS

COMPOUNDS MADE IN BAR, SPRAY OR PASTE

Trade Literature

chromium coloring compositions, emery paste and cake, greaseless compositions, hard-rubber and plastics compositions, lime compositions, lime (powdered and lump), liquid compositions (Acme) and equipment for its use, polishing tallow, principal classifications of buffing compositions, pumice (powdered and lump) recommendation chart and index, rouge (bar and powdered), stainless-steel and carbon-steel compositions, Tripoli compositions, Tripoli (powdered), water-dispersible compositions, and white coloring compositions. For your copy, use Reader Service Card.

L—704. Phosphate Coating of Moving Metal Parts—Moving parts made of iron and steel can get two-fold protection with a "Rustshield 2" treatment announced by Octagon Process, Inc., 15 Bank Street, Staten Island 1, N. Y., namely (1) by retention of lubricating oils to eliminate scuffing and galling and to reduce break-in time of rubbing and sliding surfaces of precision parts, such as thrust washers, pump pistons, gears, valve roller pins, stems and guides, as well as bearing surfaces of every type; and (2) by improvement in corrosion resistance, the degree of such resistance being increased by finishing with a drying oil or wax, such as yellow beeswax. Close tolerances are not affected by the phosphate treatment.

Rustshield 2 is said to be one of the few products meeting the requirements for phosphate coatings in the U. S. Army Ordnance Specification 57-0-2C, Type II, Class A.

The simple, inexpensive immersion process consists of precleaning with vapor degreaser, safety solvent, or an alkali cleaner especially designed for cleaning prior to phosphating (such as Octagon 400); rinsing; Rustshielding; rinsing; and final treatment with a passivating agent, such as Neutralyte solution. The Rustshield liquid is applied by hot immersion, and except for a stainless-steel tank, requires no special equipment. For further information and process specification 14, use Reader Service Card.

L—705. Removal of Furnace Scale from Steel Forgings—The Pennsylvania Salt Manufacturing Company, 1000 Widener Building, Philadelphia 7, Pa., is marketing a chemical bath which is said to cause complete removal of forging scale during subsequent quenching and to account for cost savings of 90 per cent over previous methods. If the scale is not removed completely, it interferes with machine tool setting and quickly wears down cutting tools. If left on finished parts, pieces of the scale will eventually drop into mechanisms, such as transmissions, and wear other working parts rapidly.

The bath is made of Pennsalt SR-4, dissolved in weak muriatic acid and water, a product developed by the Spicer Manufacturing Division of the Dana Corporation and Pennsalt researchers.

The Pennsalt SR-4 bath requires no heating and is made up in ordinary rubber-lined tanks. Dipping baskets can be made of simple sheet iron. Parts covered with forging scale are immersed in the bath for 5 min and then may be placed directly into heat-treating furnaces or can be stored for later heat treating.

Following the heating the forgings are water quenched and tempered. In conventional operations, the tenacious furnace scale is then removed by expensive sand- or shot-blasting, but with the use of the SR-4 bath, the scale usually blasts off from all surfaces, leaving them perfectly clean for subsequent machining. For your copy of a New Product Bulletin describing Pennsalt SR-4, its properties and method of application, use Reader Service Card.

L—706. Baskets, Crates, etc.—Rolock Incorporated, Fairfield, Conn., offers Catalog No. B-8, which contains descriptions of 75 custom-built fabricated alloy heat-treating baskets, crates, racks, retorts, trays, muffles, fixtures, etc. Featured is the new "Serpentine" Grid (patent applied for), a fully articulated design developed to meet the need for a grid that will retain its shape in high-temperature heat-treating operations, yet be light in construction and reasonable in cost. It may be used as a brazing tray or, with superstructures added, as a furnace basket for annealing, pickling, quenching, etc.

Drop-bottom baskets, pit-type stacking baskets, nesting and lift-post assemblies of heat and corrosion-resistant al-

OCTAGON ... for...
Electroplating Chemicals
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Nickel sulfate (imported)
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loys complete a line for use in dry heat and salt-bath operations. For your copy, use Reader Service Card.

L—707. Movable Blast Cleaner—A catalog issued by Vacu-Blast Company, Inc., 350 Peninsular Ave., San Mateo, Calif., tells in detail of uses and advantages of the "Vacu-Blaster", compact, movable blast-cleaning equipment for metal, concrete, brick, stone or wood surfaces.

The catalog contains numerous drawings and photos showing how the Vacu-Blaster works. A section deals with unusual or difficult blast-cleaning applications, to metal patterns, molds, storage tanks, armatures, steel drums, concrete surfaces, etc. It also gives operating details on the Generator-Reclaimer and Dust Collector units which comprise the complete Vacu-Blaster; on accessories, such as special blast guns, cabinets, nozzles and abrasives, and on the Vacu-Veyor, a companion equipment designed for high-speed transfer of bulk granular materials. For your copy, use Reader Service Card.

L—708. Lead Alloy Anode—The Hanson-Van Winkle-Munning Company has issued a "Chrom-Flo Anode Bulletin CFA-100". A departure both in alloy and design, this chromium plating anode is said to offer many attractive performance qualities: The use of special alloy lead, Type "S", reduces the formation of insoluble chromate film on the anode. An open cross-section design makes higher current density possible because of better circulation of solution and increased anode-surface exposure. Easier handling is possible because of decreased weight. These anodes supply good covering power, especially on difficult-to-plate parts. For your copy, use Reader Service Card.

L—709. Phosphate Treatment—An 8-page booklet describing Anchorite 100, a paint-anchoring corrosion-resistant phosphate treatment for metals, has been published by Octagon Process, Inc., 15 Bank St., Staten Island 1, N. Y. Attractively printed in two colors, the booklet describes in detail the common causes of paint failure and how they can be prevented. It then goes into methods of application—immersion and spraying—of the Anchorite 100 treatment.

A separate illustrated discussion of typical products to which the process can be applied includes a number of defense items. The booklet points out that the pre-painting treatment is one of the few that meets the specifications for Class C, Type II, finish in U. S. Army Specification No. 57-02C, as well as for JAN-C-490, Grade 1. For your copy, use Reader Service Card.

L—710. Degreasers—A 12-page illustrated bulletin describing the company's line of degreasing equipment has just been published by Phillips Manufacturing Company, 3475 W. Touhey Ave., Chicago 45, Ill. It gives a detailed picture of how the degreasers operate, what types of manufacturing industries use degreasers, and to what specific applications vapor degreasers can be put. The full line of vapor degreasers is shown in the bulletin along with the features, capacities and uses of each unit. A number of photographs show industrial applications of degreasers for both tank-type and conveyorized units. For your copy, use Reader Service Card.

L—711. Photoelectric Colorimeter—Photovolt Corporation, 95 Madison Ave., New York 16, N. Y., offers a new edition of its 20-page Bulletin No. 420, "Lumetron Photoelectric Colorimeter, Model 402-E". This Bulletin has been completely revised and enlarged by the description of a number of recently developed accessories. For your copy, use Reader Service Card.

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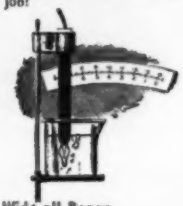

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Electrodes covering the full pH range permit accurate measurements even at extreme limits with negligible sodium ion error whether test solution is hot or cold!

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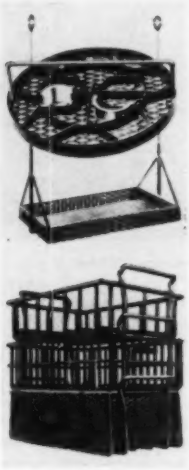
Beckman glass electrodes are factory-sealed, require no maintenance, feature patented internal shielding, heat-resistant construction, integral leads and many other advantages!

Beckman Instruments include: pH Meters and Electrodes—Spectrophotometers—Radioactivity Meters—Special Instruments

Equipment and Supplies

E—790. Rubber Coated Handling Equipment—With faster production being required and more precise and fragile parts being specified, the extra cost of tough, yet soft rubber or synthetic covering on material-handling equipment is being paid for quickly in savings on rejects.



Automotive Rubber Company has been a factor in the development of rubber-cushioned baskets, pans, spacers, chutes, hooks, racks, etc., for handling of large quantities of fragile parts, faster and without slippage, marring and scratching. Even inspection of Air Corps and Army Ordnance parts can be satisfied when handled with rubber protection using ARCO's seamless dip process or sheet lining. For answers to your specific questions, write to Automotive Rubber Company, Inc., 8601 Epworth Blvd., Detroit 4, Mich.

E—791. Phosphate Coating Aids Cold Working, Cold Extrusion of Steel—Pennsylvania Salt Manufacturing Company, 1000 Widener Building, Philadelphia 7, Pa., offers the Pennsalt Foscoat Process—compatible cleaning, pickling and phosphate coating and application of special lubricants Foslube, to steel. A heat-resistant lubricating surface is produced which is said to possess exceptional adhesion even under the most severe working conditions. The new phosphate coating chemical bath was developed by researchers of the Heintz Manufacturing Company of Philadelphia.

The efficiency of the Foscoat Process is claimed to have been successfully demonstrated in cold extrusion. Of more imme-

Here's why PROMAT STABILIZED ZINC MEETS MILITARY SPECIFICATIONS

PROMAT STABILIZED ZINC

after 200 hour salt spray test

THE TEST: Promat additive C-42 in zinc plating bath followed by Promat 2080 (20-1 dilution) in a simple secondary dip. Exposed 200 hours in salt spray.

RESULTS: No white corrosion or red rust. Only a slight stain apparent.

HERE is proof that Promat stabilized zinc answers the need for protective finishes on both civilian and military items. Promat 2080 is an O.D. type finish. It can be used from 20 to 80 concentrate depending on color and amount of chrome deposit required. Promat 2080 finish complies with: U.S. Army Specification 57-0-2c, Amendment 2; Navy Ordnance Specification 1374; Air Force Specification An-P-32, Paragraph C-2d; and Signal Corps Specification 72-53, Paragraph E-2a (4). In addition to providing excellent corrosion resistance, low cost Promat secondary treatments make the surface paintable as well. Bright, semi-bright, dull and olive drab finishes are available.

It will pay you to find out about new things from Promat — preparation, plating and secondary treatment that give zinc new importance.

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describing Promat products for better zinc plating.

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Equipment and Supplies

diate importance are the results in such applications as tube drawing, wire drawing, deep drawing (ironing), deep stamping, cold-heading and similar cold-working operations.

Significant economies are said to include elimination of intermediate press operations, annealings and chemical-treatments; reduced consumption of chemicals; increased production with existing equipment; savings in metal or reduction in scrap losses, and considerable extension in the life of costly dies. For further information, use Reader Service Card.

E—792. Tumbling Machine—The Grav-i-Flo Corporation, 400 Norwood Ave., Sturgis, Mich., has added a new model to its line of Grav-i-Flo tumbling machines. With two 18 x 40-inch I.D. compartments, the new Model 36-2 machine offers increased capacity per unit of floor space over previous equipment, and is said to permit the grinding, deburring and finishing of metal parts in larger quantities and shorter time cycles.

Features include: compartments with ½-inch plate unlined or ¾-inch plate rubber-lined; doors with cam locks having manually released safety stops to provide pressure relief; magnetic starter with reduced-voltage control to meet plant electrical standards. A lever is standard on the machine, but a push-button switch is optional; barrel rotation stops when counterbalanced guard is lifted; the 220–440 volt, 5-hp motor has a magnetic brake. Water and electrical services are integral with the machine and available for instant, convenient connections. Hoist pan has tubular yoke with lock. For further information, use Reader Service Card.

E—793. Heating Coils and Heat Exchangers—United Chromium, Incorporated, 100 E. 42nd St., New York 17, N. Y., now supplies Unichrome tantalum heating coils and tantalum heat exchangers in standardized units or made to order.

Tantalum is resistant to all of the acids

The Fundamentals of Electrochemistry and Electrodeposition

by SAMUEL GLASSTONE

Third Printing

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This book in its simple language is useful both to the practical plater who needs to know the why's of his business and to the chemist who feels a need of reviewing electrochemical principles.

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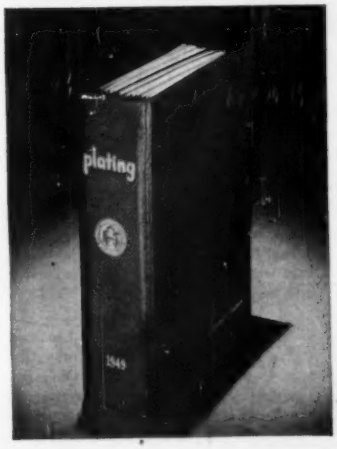

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commonly found in the plating room, except straight hydrofluoric acid. It is especially recommended for chromium plating solutions for long life and freedom from the corrosion that forms heat-insulating coatings and present a maintenance problem. Tantalum tubing stays clean and shiny. While excellent for acid solutions, tantalum should not be used in alkaline baths. For further information, use Reader Service Card.

E—794. Spectrophotometer Absorption Cells—Beckman Instruments, Inc., S. Pasadena 72, Calif., has perfected a method of producing matched 10-mm Pyrex Absorption cells for its Model B and Model DU Spectrophotometers so that these cells can be mass-produced at a new low price.

These new cells feature optically polished outer surfaces. All cells in a single shipment are matched within 3 per cent transmission at 320 millimicrons, and the light-path length of each individual cell is held ±0.025 mm. They are recommended for all applications in the range of 320–1000 millimicrons where the critical matching tolerance of the Corex type cells is not required. For further information, use Reader Service Card.

E—795. Derusting and Interim Rust Prevention—The use of Magnus D-Scale-RW for removal of rust without attack on the base metal is typified in a report received by the Magnus Chemical Company of Garwood, N. J., on the use of this product in the cleaning of spools used for copper wire. The company in question uses from 800 to 4,000 6- and 7-inch copper plated steel spools per day that soon rust in varying degree, depending on the care exercised by the wire customers before they return them to the supplier.

Formerly, degreased spools were hand brushed on a powered wire brush, said to be a slow and expensive method. Now the degreased spools, in a basket, are dipped in a hot solution of Magnus D-Scale-RW (190° F), and held there for 7–10 min on the average. They are given a cold-running-water rinse and then dipped into a solution of Magnus 63 to neutralize traces of D-Scale-RW which might remain. D-Scale-RW is an inhibited acid cleaner, said to be perfectly safe on metals for moderate periods of contact, but the alkaline cleaner is used as a security treatment that leaves a soap film which prevents rusting between cleaning and re-use.

The method is so simple and effective that spools are now derusted every time they are returned to the plant. With the wire-brush method they were cleaned only every third time. For further information, use Reader Service Card.

E—796. Acid Dragout Reduction—Specially compounded for use in mineral acid solutions, Nopco 1067-A, manufactured by Nopco Chemicals Company, Harrison, N. J., is a surface-tension depressant for use in pickling, anodizing, wire treatment and similar operations. The drain-off of pickling solution from the work is said to be greatly increased by small additions of this material. The lowered drag-out reduces acid contamination in subsequent processing.

Low surface tension values are maintained in cold and hot sulfuric and other acids in concentrations up to 25 per cent. Drainoff may be increased by 30–40 per cent. Where fuming occurs, the use of this surfactant makes possible the elimination of expensive exhaust systems. For further information, use Reader Service Card.

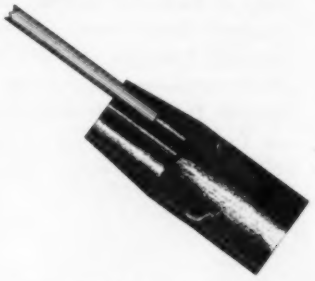
E—797. Lignum-Vitae for Acid Resistance and Wear—Lignum Vitae Products Corporation, 96–100 Boyd Ave., Jersey City, N. J., recommends parts made of lignum vitae, a tropical, exceedingly hard wood, for drain boards, pipe fittings, immersed bushings and bearings. For further information, use Reader Service Card.

E—798. Processing Conveyor—Shuler Conveyors, Inc., 43 Hutcheson Place, Lynbrook, N. Y., has developed a Work Processing Transfer for use with overhead conveyors. It consists of drop sections, placed above processing tanks, onto which the parts are transferred from the conveyor without the use of intricate mechanisms. The conveyor comes to a stop, the work is dropped into the tanks for the desired period of time, and is then brought back to conveyor level. The conveyor starts automatically, the work is transferred back onto the conveyor, and moves on, until the operation is repeated. For further information, use Reader Service Card.

E—799. Polyethylene Valves—American Agile Corporation, Plastics Division, 5806 Hough Ave., Cleveland 3, Ohio, offers 1- and 2-inch bore valves which are fabricated throughout from polyethylene, except for the packing rings which are made from a polyethylene-polyisobutylene mixture.

These Agilene Valves are light in weight (1 and 3¼ lb, respectively) and are said to be more resistant to most corrosive chemicals, including hydrofluoric, sulfuric, nitric and hydrochloric acids at temperatures up to 170° F, than stainless steel and other corrosion-resistant, higher-priced alloys. The valves are furnished with standard drilled flanges for easy incorporation into existing installations or for use in new pipe-line assemblies. For further information, use Reader Service Card.

E—800. Carboy and Drum Pouring Spout—Merchants Chemical Company, 3100 S. California Ave., Chicago 8, Ill., offers the Merco Pouring Spout. Made of

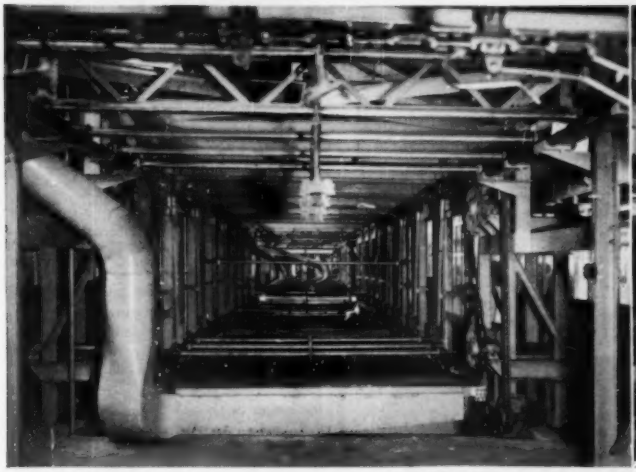


rubber with stainless steel tubing and having a flow rate of about 7 gal/min, it is said to furnish a steady flow without spillage or dripping. For further information, use Reader Service Card.

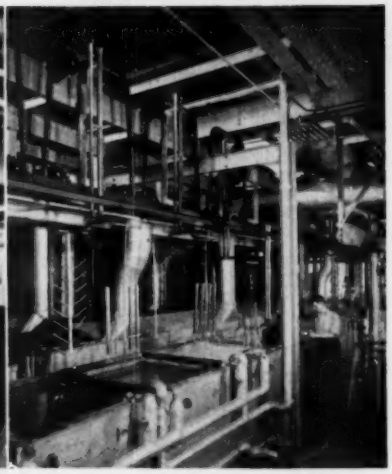
E—801. Tumbling Compound for Ferrous Metals—Tumb-L-Magic, said to be a greatly improved wet-process tumbling compound, is a new addition to the line of Tumb-L-Matic processes for metal and plastics finishing offered by Tumb-L-Matic, Inc., 4510 Bullard Ave., New York 70, N. Y. The special properties of this new formulation are attributed by the manufacturer to the chemical cleaning action of the material whereby grease and cuttings are suspended in the solution instead of accumulating on work surfaces and abrasive media retarding the action of the latter. Use of Tumb-L-Magic in conventional tumbling equipment is said to result, faster, in a higher finish than was formerly obtainable. For further information, use Reader Service Card.

E—802. Corrosion Resistant Linings, Parts—The Van Dorn Iron Works Co., 2685 East 79th St., Cleveland, Ohio, has established a Lucoflex Division that is producing many industrial products from Lucoflex, a non-plasticized polyvinyl chlo-

in your plating How to Get Greater Production Improved Quality Better Working Conditions

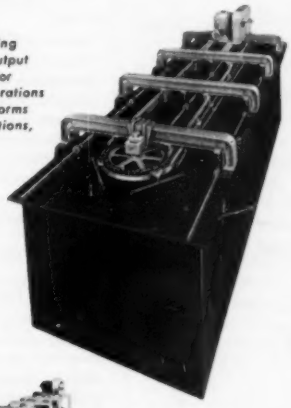


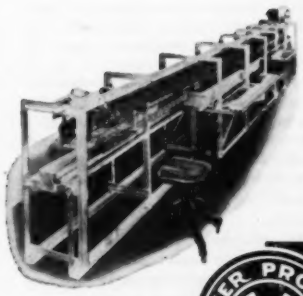
Typical Meaker Straight-A-Way Automatic Plating Machine. This type unit is designed to handle 125 racks or more per hour.



Meaker Return-Type Automatic Plating Machine for chromium-plating the large variety of parts in a high-quality line of plumbing hardware. Machine may be designed to copper plate, nickel plate and chromium plate in one continuous line.

A Meaker Semi-Automatic Plating Machine for use in medium-output plating departments and also for supplementing the plating operations in a Full Automatic which performs the cleaning, preplating operations, final rinsing and drying.





A special machine designed by Meaker for cleaning and silver plating small, brass contact clips.

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Here's how! A Meaker plating machine makes every operation in the plating sequence automatic, or as mechanized as possible. This cuts to a minimum the manual handling of the parts in process—increasing production. The control of the quality of the plating is set and practically independent of the varying human element. A Meaker plating machine does clean up the plating room making for safer and more agreeable working conditions. And a bonus—in many cases the savings in the over-all plating costs have paid for the equipment in a short time.

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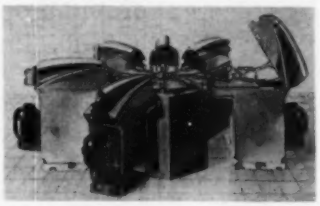
ride. Manufactured into rigid sheets, tubes, bar stock and molding powder, and capable of being welded, machined and formed, this material does not age and is resistant to almost all acids, alkalies and many chemical solutions. Water vapors will not permeate it, and it is unaffected by temperatures between 50 and 177° F.

Major uses include tanks, tank liners, ducts and piping, in chemical operations, plating, pickling, etc.

Lucoflex is available in ample supply. The Lucoflex Division has design engineers experienced in properly applying this material to specific industrial uses. For further information, use Reader Service Card.

E—803. Micro-Lap Equipment—The Murray-Way Corporation, Birmingham, Mich., has developed an automatic precision-polishing process which will be known as Micro-Lap. The process and equipment were developed especially for the fast, accurate and economical micro-surfacing of jet-engine blades and buckets but is said to have a wide range of other applications.

The Micro-Lap jet blade installations are 8-station, hydraulically indexed units. Additional or fewer stations may be had as required. The heads are mounted on floor bases and operate continuously with no pause for indexing. The polishing jaws open automatically to receive and release the work-piece as it makes the cycle.



Successively finer grits under flood lubrication are used to accomplish a finish of 3–4 R.M.S. in a 6-second cycle. Cycle time and individual-station dwell times are fully adjustable to meet job requirements. Head stroke may also be changed for longer or shorter blade lengths.

Murray-Way Corporation has also developed equipment for the automatic machine-blending and polishing of the leading and trailing edges of air foil. For further information, use Reader Service Card.

E—804. Reducing-Atmosphere Powder—A powder, called Atmosand, decomposes under the effect of heat to liberate a hydrogen, carbon monoxide and nitrogen gas mixture suitable for use in furnaces and other heaters not equipped with generating units. Gas produced by this material prevents blueing, scaling and decarburization of steel, brass, copper and other nonferrous metals. It will also serve as a laboratory source of hydrogen without cylinders.

Sold by Marlyn Chemical Co., Inc., 156 and Forsythe Ave., Calumet City, Ill., the powder is said to be nontoxic, noninflammable, and whereas the atmosphere is slightly more expensive than regularly generated gas, no capital outlay is necessary to supply existing equipment with protective atmosphere. For further information, use Reader Service Card.

E—805. Rectifier—Electronic Rectifier Company, Inc., Rochester, N. Y., offers two selenium rectifiers, Types N150VP and N150BQ. They have a full-wave rectifier circuit with voltage continuously variable from 0 to 8 volts at 150-amp capacity, or 0 to 16 volts at 75-amp capacity.

D-C voltmeter and ammeter are of 3½-inch rectangular panel type with D'Arsonval movements and 2 per cent accuracy. A fully magnetic circuit breaker is used. The steel cabinet has hinged top cover for access to A-C terminal strip. Size is 22 inches wide by 18 inches deep by 25 inches high, weight 160 lb. For further information, use Reader Service Card.

Greetings of the Season

The folks at Magnuson's wish friends and customers, all and everywhere, a full measure of happiness and good cheer through the forthcoming holiday season.

While extending Greetings this month to readers of PLATING *we would not break the continuity of Cards for your Technical Purchasing and Index File.*

The Card for December is shown below—

Solvent Pre-Soak

PERMAG Non-Electrolytic Cleaning Compound

PURPOSE
a. Used to assure maximum penetration and complete removal of buffing compounds and other hardened soils.
b. To secure economy through speed and efficiency.

REQUIREMENTS
a. Must yield consistent superior results.
b. Must not carry-over and contaminate plating solution with organic matter.
c. Must afford minimum of solvent hazards.

CONSIDERATIONS FOR SELECTION
a. Evidence of essential need.
b. Proper degree of safety.
c. Easily demonstrable efficiency.

Look for another fact-packed Card next month on Metal Cleaning with PERMAG.

Magnuson Products Corporation

Mfrs. Specialized Cleaning Compounds for Industry

50 Court St. BROOKLYN 2, N. Y.

In Canada: Canadian PERMAG Products Ltd., Montreal, P. Q.

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News about

COATINGS for METALS

Metallic ..... Organic ..... Decorative ..... Protective

Chromate treating costs reduced

with UNICHROME DIPS for zinc

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DECEMBER, 1951 VOL. 38, NO. 12

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Contents

Barrel Finishing I. Some Fundamentals 1240
Morris S. Shipley

Nickel Plating with Insoluble Anodes 1243
W. A. Wesley, D. S. Carr and E. J. Roehl

Ultrasonic Cleaning Device 1255

Electroplating of Gold Alloys 1256
Edward A. Parker

Washington Orders 1262

The Electroplating Industry in Atlanta 1262
Louis Rosenberg

Cleaning and Preparation of Metals for Electroplating. IV. Degreasing Evaluation Tests: Sequential Testing 1263
Henry B. Linford and Edward B. Saubestre

Third Industrial Finishing Exposition 1267

Monthly Features

Industry News 1206
Personals 1214
Trade Literature 1222
Equipment and Supplies 1228
Editorial 1239
Question Box 1261
Book Review 1268
Article Abstracts 1270
Patent Abstracts 1273
A. E. S. News 1280
Branch News 1282
Membership Report 1296
A. E. S. Directory 1298
Advertising Index 1301
Future Meetings 1302

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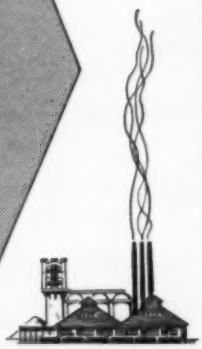

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Editorial

Is There a Santa Claus?

TALKING TO A PLATER-FRIEND the other day, we were shocked to hear him say, "There is no Santa Claus any more". We tried to picture in our mind the coming Christmas without that benign being—no deep throated chuckle, no twinkling of the old eyes, no gifts for either children or grownups. A dreary Christmas indeed.

Our friend was, of course, talking about the empty storeroom in his shop and of his thin order book for plating of civilian goods. Washington, which he and so many Americans had looked upon as a friend in need, did not seem interested in him any longer. Busy with defense preparations, it had shaved off its whiskers and cropped its hair, and did not look at all like that friendly old gentleman, Santa Claus.

Isn't there a Santa Claus? If we were inhabitants of Korea or Malaya or Indo-China, or soldiers fighting in those plagued countries, we would have reason to doubt his existence. But although his gifts may not be as plentiful as before, we civilians in the Western world still receive many presents, not only of life's necessities but also of those frivolous trifles that like carbon dioxide bubbles make the difference between luxurious champagne and everyday table wine.

When we count our blessings we must conclude, "There certainly is a Santa Claus".

Merry Christmas!

Gustaf Soderberg

Fig. 1. Preparing a production load for a large horizontal tumbling barrel. Courtesy Norton Company, Worcester, Mass.

BARREL FINISHING

I. Some Fundamentals

MORRIS S. SHIPLEY

President, Industrial Supplies & Equipment Company, Greenwich Conn.

Introduction

During World War II, and more recently, great advances have been made in both the techniques of tumbling and the results secured.

In the early days of tumbling, the equipment was confined largely to the open-end tilting-type of barrel. Such barrels were operated with fairly light loads at high speeds, and where abrasive was used, sand and gravel were generally relied upon. This type of barrel still has usefulness in some self-tumbling and other specialized operations, but for high production and critical operations, it has been replaced by the horizontal barrel.

Only when the horizontal, closed barrel of comparatively large diameter had been developed could the full potentialities of barrel finishing be realized. This type of barrel made possible heavier loads, lower speed, and the full use of special abrasive chips or hardened steel balls and shapes.

Results are secured by a low-pressure random honing or polishing action made possible by the comparatively slow turning of the barrel. Water, and a suitable compound or cleaner, serve a dual purpose. They tend to lubricate the operation so that as the abrasive chips pass over flat or curved surfaces they do not cut too deeply but merely smooth or polish. The action on jagged or rough edges, however, is much more severe, making it possible to deburr or round these edges without damage to the other surfaces. Compounds also help to keep the parts clean and provide rust protection for short periods.

Applications

Barrel finishing can be divided into three categories: (1) deburring, definning and creating of radii (often called "cutting down"); (2) abrasive burnishing for smoothing and creation of microfinish; (3) ball burnishing for highest possible lustre, or color. The first two often replace abrasive wheel and belt operations ranging from No. 80 grit to No. 400, and the third will perform many of the functions of buffing.

It should be remembered that, because of the nature of the operation, barrel finishing cannot replace hand operations in all cases. As the barrel method works all surfaces of the parts, it is not applicable to parts which require two different finishes or where only a portion of the part is to be worked. Again, some

forgings may require "snagging" of the worst edges before being placed in the barrel. It is also true that ball burnishing cannot replace buffing where the highest grade finish is required. There are other limitations to the process, but its utility is so broad and is increasing so rapidly that it has taken its place as a standard procedure which has applications unsuspected by many production executives.

The process is applicable to parts of all kinds (stampings, castings, forgings, and machined pieces) made of such metals as iron, steel, copper, brass, bronze, zinc, and aluminum, as well as to many plastics. By means of newly developed techniques, threaded parts, gears and worms may be tumbled effectively without damage to the threads or alteration of the contours. Microfinishes can be improved on such critical parts as aircraft and other gas-turbine blades.

The finish may be varied from a rough matte to an extremely high lustre.

Uniformity of results and amazing cost reductions are the two factors which are responsible for the rapidity with which barrel finishing is being adapted as standard production procedure in both large and small manufacturing plants all over the country. Each part in a load, whether it be a handful or thousands of pieces, is worked in exactly the same way and to the exact degree as all other pieces, which is impossible in such hand operations as grinding, polishing, or buffing. Furthermore, parts can be processed in such quantity that almost unbelievable cost reductions are effected.

Operating Techniques

Most of the basic principles of barrel finishing apply both to cutting down with an abrasive medium and to ball burnishing. The following outline applies specifically to cutting down. Following it come certain detailed remarks about ball burnishing.

Every variable in connection with a particular job has a bearing on the result, but five *basic factors* are of prime importance:

1. Total load
2. Proportion of work to medium
3. Water level
4. Barrel speed
5. Time cycle

Other factors of almost equal importance are:

6. Size of medium
7. Compounds or cleaners
8. Proper rinsing

Total load

The results to be secured in any barrel-finishing operation might be expressed in an equation something like

$$M \times S \times T = R$$

where M = mass
S = speed
T = treatment time
R = result

Thus it reads: Mass, times speed, times duration of operation equals result

Mass (which means weight) is required to give sufficient pressure that the honing action can take place effectively.

In general, the barrel should be loaded from 60 to 75 per cent full. To load less than 60 per cent reduces both the effectiveness of the operation and the useful parts load. A load of 60 per cent of total barrel volume is normal for cutting-down operations, as it takes advantage of the full effective diameter of the barrel. Larger loads, up to 75 or 80 per cent, are sometimes used for finishing because of the increased cushioning effect, but processing time is increased. Conversely, loads of less than 60 per cent tend to invite impingement and nicking and definitely increase the time required to secure equivalent results.

If only a few parts are to be processed, the barrel must still be operated with a full load in order to pro-

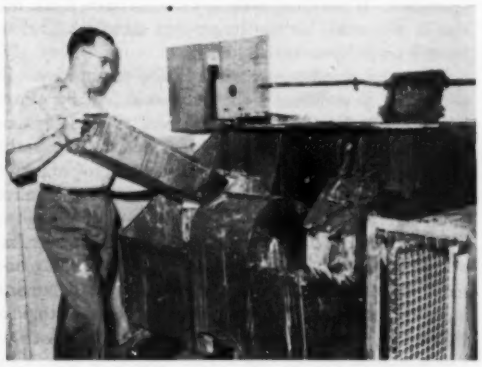

Fig. 2. Loading a small-lot tumbling barrel. Courtesy Norton Company, Worcester, Mass.

Fig. 3. Preparing a tilting barrel for drying of parts in ground corn cob or sawdust. Courtesy Norton Company, Worcester, Mass.

vide sufficient mass to do the job effectively. The load, in this case, must be built up with medium.

Proportion of medium to work

It should be noted at the start that in discussing proportions of medium to work (a) proportions are measured by volume, not by weight, and (b) the first figure applies to the medium and the second to the work; e. g., a proportion of 2 to 1 means 2 parts of media to 1 part of work, not the reverse.

Here it is possible to lay down only very general rules. Certain small parts can be tumbled without any media at all, which is known as self-tumbling. But these are exceptions. The size and shape of the part, as well as the material itself and the results desired, govern the proportion of parts to medium.

In general, it runs 2 or 3 parts of medium to 1 part of work. Smaller, less critical parts may require only 1 to 1, but more critical or more delicate parts may require as high as 4 or 5 parts of abrasive to 1 part of work.

Often, only trial runs will provide the final answer, and the inexperienced operator will do well to get expert advice until he has gained experience. Such advice is readily obtainable from most manufacturers of tumbling equipment or abrasive. The less experienced operator should have no hesitancy about admitting the necessity for such experimentation, for all experts depend on experimentation to determine the optimum proportions for a given job.

Water level

The amount of water in the barrel varies somewhat according to the job to be done. In general, a "low water level" (slightly below the level of the load) is used for fast cutting, and a "high water level" (well over the level of the load) is used for finishing.

In ball burnishing, however, it is usual to use water just about to load level.

Barrel speed

The proper barrel speed for each individual job is just as important as proper loading. Certain parts can be processed at 10 rpm but would be ruined at higher speeds; others would take an unreasonably long time at speeds under 20 or 25 rpm. Again, higher speeds are used in most cutting-down operations, whereas lower speeds are used to improve finish or to prevent impingement and nicking.

In deburring certain parts with sharp edges, the barrel may be operated at 10 rpm until the worst of the points have been blunted. Then the speed can safely be increased to complete the cutting down in a reasonable time. Such parts could easily be ruined by starting the operation at higher speeds.

It is obvious, then, that for many operations a variable speed barrel is essential. With barrels of 30-36-inch diameter, a range from a low of 10 rpm to a high of 25 rpm is suitable for practically all production purposes.

Time cycle

Experienced operators can usually estimate fairly accurately the time required to do a job, simply by examing the part. Even they, however, usually check the progress of the job for satisfactory results. Almost invariably there is an optimum time cycle for each part. Putting it another way, there comes a point of diminishing returns beyond which little additional improvement is secured, regardless of how long the part may be processed.

It is also true that, in some cases, the cutting down operation can actually damage the part if continued too long.

Less experienced operators who are required to determine effective time cycles for new jobs will check the progress of the job periodically and will continue the operation only until acceptable results are obtained. Once the cycle has been determined, the operation becomes almost automatic, particularly if the barrels are equipped with automatic timing devices.

Selection of size of media

Use of the best chip size or sizes for each job is of great importance, and less experienced operators should avail themselves of expert advice from the manufacturer of the abrasive or the barrels which they use. The more important considerations in selection of chip size follow:

(a) Check the part and eliminate all sizes which will lodge in holes or recesses.

(b) Eliminate those sizes which approach part size and therefore make separation by screening impossible. If magnetic separation is intended, this point need not be considered.

(c) Select the best chip size from those remaining by a consideration of the several factors discussed in the following paragraphs. Even the experienced operator, however, may require test runs before arriving at the optimum size.

To deburr, remove stock, or form a radius, use as large a grain as possible in the roughing (or cutting) operation. If finishing is done with abrasive, a smaller size is necessary, as the larger-size abrasives tend to leave a scratchy or matte finish.

Wherever possible, use a single size of abrasive. In general, if two different sizes are used, cutting down is no faster than the cutting rate of the smaller-size abrasive. Also, the larger chips tend to crush the smaller ones, causing faster consumption of abrasive with more rapid formation of sludge, which requires more careful rinsing.

When two different sizes are indicated, however, no attempt should be made to do the job with only one size. Mixtures are particularly useful in deburring holes and crevices. Chips of a size small enough to pass through the hole freely and a size too large to enter it will help to prevent burrs from turning in since they are worked from both sides. The same principle applies to deburring of gear teeth and threaded parts.

(Continued on page 1260)

NICKEL PLATING WITH INSOLUBLE ANODES*

W. A. WESLEY†, D. S. CARR‡ AND E. J. ROEHL§

Introduction

There are advantages inherent in the use of insoluble anodes for nickel plating which make it highly desirable for certain types of industrial work even though it is not suitable for most decorative work. Pertinent examples are the coating of the inner surfaces of pipes and tubes; the plating of rolls, strip or wire at high current densities; the electroforming of complicated shapes; and the electroforming of screen mesh at high rates of deposition. The advantages include:

1. Elimination of anode bags.
2. Permanent anode shape, permitting close and unchanging anode-to-cathode spacing. This is of prime importance in continuous strip plating, plating the inside of tubes, and in the use of conforming and auxiliary anodes.
3. Reduction of anode-scrap losses.
4. Elimination of addition agents normally required to prevent pitting. The oxygen evolved at the insoluble anode effectively counteracts pitting.
5. Agitation by the gas evolved at the anode which aids in reaching high anode and cathode current densities.
6. Possible beneficial effect in oxidizing organic bath contaminants at the anode.

Against these can be reckoned the following disadvantages:

1. Inability to employ bright-nickel baths in this process inasmuch as the organic ingredients tend to be oxidized at an insoluble anode.
2. The added cost of a replenishing process.

Replenishment

Plating with insoluble anodes decreases the nickel content and increases the acidity of the electrolyte; hence a replenishing system must be provided to maintain these factors constant. Several methods have been suggested or employed for this purpose, namely, periodic or continuous treatment with nickel hydrate or carbonate[1]; circulation of the electrolyte through beds of nickel scrap, shot or powder[2]; electrolytic replenishment in a cell containing a porous diaphragm[3].

The basic-compound treatment is being applied commercially, but it utilizes a costly source of nickel and is difficult to carry on continuously in such a way as to avoid large fluctuations in the nickel content and *p*H of the electrolyte. If nickel carbonate is used special care must be taken that all carbon dioxide be removed from the solution before it is pumped back into the plating cell[1]. Attempts to replenish nickel baths by contact with nickel powder, shot or scrap have not been satisfactory because of the tendency of nickel to become passive in chloride-free electrolytes. Improvements upon the method involving activation of the nickel with sulfur[4] and a method based on the use of chloride-containing electrolytes in conjunction with apparatus to take care of the chlorine generated at the insoluble anode[5] have been patented. The porous-diaphragm method has been used for some plating baths, but it is not easy to maintain the diaphragms in good condition, a high resistance is introduced which increases power costs, and other disadvantages have been noted[3,5,6].

It was felt that a quite different approach to the problem was needed, and an experimental program was instigated to find a combination of conditions of operation of an electrolytic regenerating cell under

*A paper presented at the 1951 Convention of the American Electroplaters' Society in Buffalo, N. Y.

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TABLE I. CORROSION OF NICKEL ELECTRODES UNDER INFLUENCE OF ALTERNATING CURRENT

Electrode area: 5.4 in² (35 cm²) each. Solution volume: 2 l (2.1 qt)

Electrolyte	A-C Current		*p*H	Time	Electrode Wt/Loss		Relative Electrode Efficiency‡
	Amp	asf		hr	g	g/hr	%
Watts*	0.5	13.5	2.0	93	2.5	0.027	5
Watts*	1.5	40	2.0	66	3.0	0.045	3
Watts*	1.5	40	1.0	96	11.1	0.116	7
Sulfate†	6.0	160	1.0	25.5	5.3	0.21	3
Sulfate†	7.0	187	1.0	23	5.7	0.25	3
Sulfate†	12.0	320	1.0	24	20.2	0.84	6

*$NiSO_4 \cdot 7H_2O$, 242 g/l; $NiCl_2 \cdot 6H_2O$, 26 g/l; H_3BO_3, 19 g/l
†$NiSO_4 \cdot 7H_2O$, 300 g/l; H_3BO_3, 30 g/l
‡Anode minus cathode

which the nickel current efficiency at the anode would be greater than that at the cathode. The regenerating cell would then tend to correct the changes occurring in the plating cell with its insoluble anodes where the cathode efficiency is, of course, greater than the anode efficiency (zero). The electrolyte would flow through the two cells and a filter unit connected in series.

Experimental

The use of chlorides in nickel plating baths to be operated with insoluble anodes imposes serious handicaps in the choice of anode material and in the disposal of the evolved chlorine gas[3]. It was, therefore, felt that, as a first approach, the problem should be simplified by limiting the work to a chloride-free electrolyte. Except where otherwise indicated, all the work was done in an initially purified* bath containing 300 g/l (40 oz/gal) nickel sulfate crystals and 30 g/l (4 oz/gal) boric acid at 130° F (55° C).

Commercially pure nickel containing 99.95 per cent nickel plus cobalt (0.5–0.7 per cent cobalt) was used for soluble anodes in the studies of regenerating-cell behavior. For insoluble anodes, lead sheet about 1/8 inch (0.3 cm) thick served satisfactorily. Where an electrolyte volume of 2 l (2.1 qt) is indicated, the container was a rectangular glass jar of internal dimensions of approximately 5.5 inches (14 cm) long by 2.75 inches (7 cm) wide by 10 inches (25 cm) deep. The nickel anodes were usually cut 2 inches (5 cm) wide and of a length giving the desired immersed electrode area on the face exposed to the electrolyte when they were hung across the narrow ends of the jar. The edges and back face usually were protected by a stop-off coating. In those experiments where the indicated volume of electrolyte was 4 l (1.1 gal) the glass-jar dimensions were 6 inches (15 cm) length, 5 inches (12.7 cm) width and 10 inches (25 cm) depth. Final experiments were in 10-l (2.6-gal) jars 8.75 inches (22 cm) long by 6.5 inches (16.5 cm) wide and 12 inches (30 cm) deep.

Effect of Alternating Current

Nickel readily becomes passive in a chloride-free sulfate bath operated at normal *p*H and current density, but it has been suggested that nickel can be rapidly dissolved in a sulfuric acid solution with the aid of alternating current[7]. The behavior of two nickel electrodes when corroding in the plating electrolyte under the influence of alternating current was checked, and the results are shown in Table I. The electrodes were connected to a 60-cycle 115-volt a-c source through a controlling rheostat and an a-c ammeter. Weight-loss determinations were made at several values of *p*H and current density. From the observed total loss in weight of the electrodes the overall electrolytic efficiency of dissolution was calculated according to Faraday's law. The results do indicate that there was corrosion of the electrodes, but the difference in anode and cathode efficiencies was too small to be of practical value.

Effect of Direct Current

Experiments were performed to determine at which current density nickel anodes become passive in the chloride-free solution. A 4-l (1.1-gal) bath was used, and a single nickel-plated steel cathode having an area of 6.5 in² (41.9 cm²) was mounted, with a 2-inch (5-cm) anode-to-cathode spacing, midway between two anodes of a total anodic area of 6.52 in² (42 cm²). The actual dimensions of each available anode surface were 3.0 x 7.0 cm (1.2 x 2.8 inches). All the anodes were cut from the same piece. The procedure was simply to scrub the anodes clean, start the electrolysis at a low current density, and observe the cell

*The electrolyte was purified by first raising the *p*H to 4.8 and adding 0.7 g/l (0.09 oz/gal) ferrous sulfate plus 0.7 ml/l (0.09 fl oz/gal) of 30 per cent hydrogen peroxide solution. It was then treated with activated carbon, filtered and worked at a low current density for 24 hours.

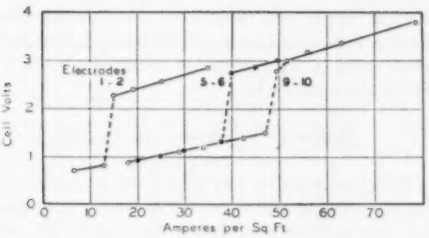

Fig. 1. Onset of passivity of nickel anodes in a chloride-free solution at 130° F and 1.0 pH

voltage at constant current until it appeared to be steady. The current was then increased and a new cell-voltage reading taken.

Typical results are plotted in Fig. 1. The onset of passivity with its accompanying evolution of oxygen is marked by a sudden jump in cell voltage. The current density at which this jump occurred was not reproducible with different anodes or even with the same pair of anodes.

The next point of interest was to determine the approximate anode and cathode current efficiencies in the active and passive ranges of current density. It will be recalled that the prime requisite of replenishment is to have conditions yielding a considerable difference in anode and cathode efficiencies, with the former the greater. For this purpose, a copper coulometer was connected in series with the cell, and anode and cathode changes in weight were determined along with current and voltage measurements. The experiment at each current density was continued long enough to insure a change in weight of each electrode of at least 0.2 g (0.007 oz), usually 1–2 g (0.035–0.07 oz).

A considerable body of data was obtained in this way but will not be given here because the reproducibility was not good. It was clear, however, that there was a range of current densities at low *p*H over which the anode efficiency was often 100 per cent while the cathode efficiency was low. At higher *p*H periodic voltage jumps took place similar to those investigated by Hedges[8]. The anode efficiency was poorer in these cases and would become very low when the current density or *p*H were raised. It was observed that a definite time interval was required for nickel anodes to become passive, and this observation led to the thinking which solved the problem.

Effect of Current Reversal

Because nickel anodes do not become passive instantaneously at ordinary plating current densities, periodic reversal of the current in the regenerating cell should serve to maintain the anode current efficiency at 100 per cent. With such periodic current reversal the two electrodes would act alternately as anodes so that build-up of one electrode with nickel would be avoided.

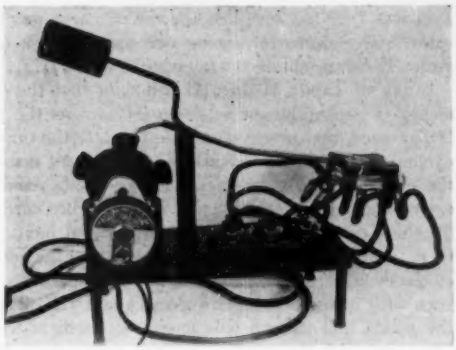

Fig. 2. Current reversing mechanism

A small current reverser was constructed as shown in Fig. 2. It was simply a clock-operated double-pole double-throw switch, made of two mercury switches, a synchronous clock motor, and a cam disk on which the spacing of projections determined the time of current flow in each direction. A 2-l (2.1-qt) cell was used with two nickel electrodes having an exposed area of 3.5 in² (22.5 cm²) each. The electrode spacing was 2-inch (5.1 cm). The edges, back, and part of the faces of each electrode were insulated with a stop-off material to confine the current flow to the exposed area. The regenerating cell was connected in series with a full-wave dry-disk rectifier, the current reverser and a copper coulometer. Cell voltages were observed with a good voltmeter to assist in estimating power requirements of the process. The results are given in Table II.

To aid in interpreting the data, measurements were made on a similar cell with the same two electrodes as anodes and a third central electrode as cathode, this time without current reversal. The effective anode

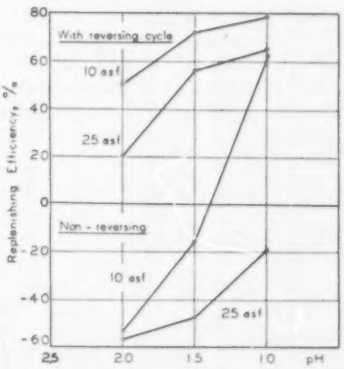

Fig. 3. Effects of pH, current density and current reversal on replenishing efficiency

area was 7 in² (45 cm²) and the cathode area was the same. The electrode spacing was again 2 inch (5.1 cm). The data obtained are given in Table III.

Study of Tables II and III will show that the efficiency of replenishment tends to increase as the *p*H is decreased, the current density lowered, or the time of cycling shortened. At low *p*H and low current density the electrode serving momentarily as anode remains active and its potential steady. With higher current densities or *p*H values the anode potential jumps to more positive values after a few seconds and the anode efficiency falls. At the same time the cathode efficiency rises with increase in current density and *p*H. Thus, the anode and cathode efficiencies are both affected adversely, and their difference (the replenishing efficiency) actually becomes negative when a unidirectional current is employed. The only conditions in Table III under which positive replenishing was observed without current reversal were at the low *p*H of 1.0 and low current density of 10 asf (1.1 amp/dm²).

The efficiency data are shown graphically in Fig. 3. Below the center line the cathodic efficiency is greater than the anodic efficiency, and the nickel content and *p*H increase. Above the center line the opposite changes occur, and conditions are favorable for an effective regenerating cell. Satisfactory results are obtained over a wide range of conditions with a 10-second reversing cycle.

Optimum Conditions for Plating and Replenishing

Thus far attention has been focussed on the problem of operating the regenerating tank. In a qualitative way it is evident that a decrease in *p*H, which favors replenishment, has an adverse effect in the plating cell because it reduces the cathode efficiency. Lowering the current density in the regenerating cell need not, however, affect the choice of operating current density in the plating cell. The lower limit of regenerating current density which can be used in practice will be determined by the size of the regenerating tank deemed feasible with regard to floor space, heat losses, cost of tank, etc. A reasonable choice might be 10 asf (1.1 amp/dm²), but this would vary in different plants.

To help in selecting a good *p*H range, experiments were performed to determine more precisely than in Table III how the cathode efficiency changes with *p*H

TABLE II. EFFICIENCY OF REPLENISHMENT WITH CURRENT REVERSAL

Complete Cycle sec	*p*H	Current Density asf	Cell Voltage				Electrode Potentials‡ volt		Amp-hr	Electrode Wt/Loss g	Electrochemical Efficiency* %
			Steady	Jumping†							
				From	To	sec	Anode	Cathode			
100	1.0	10	0.9				−0.18	−0.65	16.1	13.86	79
		10	0.8				−0.17	−0.65	17.6	15.34	80
		25	1.3				−0.13	−0.68	4.15	2.91	64
		50		1.9	3.5	25	−1.4 to +1.5	−0.70	7.08	1.67	22
10	1.0	25	1.3						5.23	3.76	66
		50		2.0	3.4	5			7.30	2.37	30
		50		2.3	3.4	3			6.41	2.69	38
10	1.5	10	1.0						6.75	5.35	72
		10	1.0						1.16	0.92	72
		25		1.5	3.1	2			3.57	2.20	56
		25		1.3	3.1	2			2.30	1.4	56
10	2.0	10		0.9	2.2	2			5.57	2.37	39
		10		1.2	2.4	2			0.90	0.49	50
		10		1.3	2.6	2			1.28	0.72	51 (Ave. 47)
10	2.0	25		1.4	2.6	2	−1.3 to +1.5	−0.65	3.46	0.82	22
		25		1.5	2.6	2	+1.2 to +1.5	−0.67	2.75	0.58	19
		25		1.8	2.8	2			10.22	2.03	18 (Ave. 20)

*Calculated from net loss in weight of electrodes, i. e., loss while anodic minus loss while cathodic.
†After the indicated time period the cell voltage increased to the indicated values in each half cycle.
‡Measured against saturated calomel electrode

TABLE III. EFFICIENCY OF REPLENISHMENT WITH UNIDIRECTIONAL CURRENT

*p*H*		Current Density asf	Cell Voltage	Amp-hr	Anode Wt/Loss g	Cathode Wt/Gain g	Efficiency %		Replenishing Efficiency* %
Start	End						Anode	Cathode	
2.0	1.7	25	3.3	3.26	0.560	2.625	16	74	−58
2.0	1.7	25	3.4	3.83	0.624	3.053	15	73	−58
2.0	1.9	10	2.7	0.93	0.140	0.693	14	68	−54
2.0	1.9	10	2.8	0.75	0.157	0.575	19	70	−51
1.5	1.4	25	3.3	2.99	0.468	2.001	14	61	−47
1.5	1.4	25	3.2	2.58	0.352	1.721	12	61	−49
1.5	1.5	10	2.5	2.92	1.204	1.681	38	53	−15
1.5	1.5	10	2.5	2.99	1.193	1.755	37	54	−17
1.0	1.0	25	3.1	8.34	1.512	3.083	17	34	−17
1.0	1.0	25	3.2	8.05	1.231	3.170	14	36	−22
1.0	1.0	10	2.3	2.46	2.695	0.998	100	37	+63
1.0	1.0	10	2.3	3.53	3.814	1.387	99	36	+63

*Anode minus cathode

at a plating current density of 50 asf (5.4 amp/dm²). Copper-rod cathodes 1/8 inch (3.2 mm) in diameter by 5 inches (12.7 cm) long were used in the 2-l (2.1 qt) cell. The results are shown in Fig. 4, where the replenishing efficiencies from Table II are also plotted.

One would conclude from Fig. 4 that an optimum relationship between replenishing efficiency and plating efficiency in a system operating at 50 asf (5.4 amp/dm²) in the plating tank and 10 asf (1.1 amp/dm²) in the regenerating tank would be reached with an electrolyte *p*H in the neighborhood of 1.5. With a higher plating current density, such as is used in plating on continuous strip, it might be economical to operate at a *p*H closer to 1.0.

TABLE IV. PRELIMINARY REGENERATIVE PLATING TEST

Plating Cell
Insoluble anode* area: 30 in²
Cathode area: 30 in² plus guard ring, total 69 in²
Total plating current: 19 amp
Effective current density on cathode: 40 asf
Cell voltage: 6.5 volts

Replenishing Cell
Total nickel electrode area: 520 in²
Total replenishing current: 19 amp
Effective current density: 10 asf approx.
Reversing cycle: 10 sec (current reversed every 5 sec)
Electrode spacing: 0.5 inch
Cell voltage: 0.7 volt

Duration of run: 28 hr

*p*H: at start, 1.3; at end, 1.2

Total electrolyte volume: 20 l
Nickel content of bath: at start, 72.5 g/l; at end, 70.7 g/l

*Antimonial lead

Plating with Continuous Replenishment

To try the proposed process on a small scale and at the same time to prepare sufficient material for determinations of the physical properties of nickel deposited from a chloride-free bath, the experiment summarized in Table IV was performed. The plating cell was a 10-l (2.6-gal) glass jar equipped with two lead sheet anodes with an immersed area 2.5 x 10.0 inches (6.4 x 25 cm) each and a central cathode of stainless steel of the same available area on each face. The cathode was equipped with a generous guard ring to insure uniform thickness of the deposit on the stainless steel. The anode-to-cathode spacing was approximately 4 inches (10 cm). The regenerating cell was also a 10-l (2.6-gal) jar, but inasmuch as this was to operate at only 10 asf (1.1 amp/dm²), five nickel electrodes were mounted in it, spaced ½ inch (1.3 cm) apart. These electrodes were each 6.5 x 10 inches (16.5 x 25 cm). They were connected to a current reverser

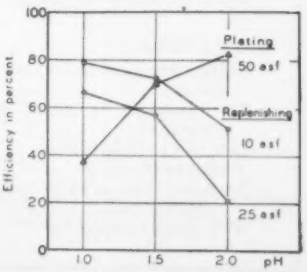

Fig. 4. Effects of pH, and current density on efficiency of plating and replenishing

TABLE V. TEST RUN TO PROVIDE ENGINEERING DATA

Electrolyte

Volume			17 l
Composition:	$NiSO_4 \cdot 7H_2O$		300 g/l
	H_3BO_3		30 g/l
Analysis (g/l)		*At start*	*At end*
	Ni	63.9	60.5
	H_3BO_3	27.0	26.0
	Pb	0.0078	0.0004
	Fe	0.0015	0.0014

Temperature ..... 130° F

*p*H variation

First 20 hr	*Next 20 hr*	*Last 8 hr*
1.4 to 1.2 (falling)	1.2 to 1.5 (rising)	1.45–1.55 (steady)

Plating cell

Insoluble anode area (chemical lead)	70	in²
Cathode area	70	in²
Plating current		
(19.5 hr at 40 asf)	20	amp
(28.5 hr at 30 asf)	15	amp
Anode-to-cathode spacing	4.5	inch
Cell voltage: 40 asf	6.8	volt
30 asf	5.5	volt
Weight of nickel deposited:		
measured	612	g
theoretical	895	g
Cathode current efficiency	68.4	%
Total power consumed	5003	whr
Power per lb of nickel plated	3.7	kwhr

Duration of Test	48	hr

Replenishing Cell

Active electrode area (each direction)	280	in²
Total regenerating current	25	amp
Effective current density	13	asf
Reversing cycle (current reversed every 5 sec)	10	sec
Electrode spacing (face to face)	1	inch
Circulating rate between cells	1	l/min
Weight of nickel dissolved, measured	605	g
Total current, measured by meter	1157	amp-hr
Current efficiency	47.8	%
Cell voltage	0.9	volt
Total power, calculated	1041	whr
Power per lb of nickel dissolved	0.78	kwhr

Material Balance

Change in nickel content of electrolyte	3.4	g/l
Net depletion of nickel from electrolyte	57.8	g
Loss in wt of electrodes	605	g
Total loss of nickel	663	g
Measured gain in wt of cathode in plating cell	612	g
Nickel unaccounted for	51	g

in such a way that alternate electrodes were of opposite sign; thus at any instant there was a total effective anodic area of 260 in² (16.8 dm²) and an equal total cathodic area, but these were reversed every 5 seconds of the 10-second reversing cycle.

The electrolyte was circulated from the plating cell to the regenerating cell by means of an air lift, and it was returned to the plating cell through a siphon tube, the outlet of which was inside a filter bag in the plating cell. The solution in both jars was stirred vigorously. At the end of the run the deposit was separated from the stainless-steel cathode and was machined into tensile specimens.

The results of the preliminary run, as shown in Table IV, were very encouraging. The *p*H of the electrolyte at the end of the test had dropped only one-tenth of a *p*H unit, and the nickel content had fallen only 2.5 per cent.

A longer test was performed to provide all the engineering data needed to design a pilot plant. A diagrammatic sketch of the apparatus is shown in Fig. 5. The more practical electrode spacing of 1 inch (2.5 cm) was used in the regenerating cell. All of the electrodes were weighed before and after the experiment, and an electronic coulometer called the "Weston Industrial Integrator" was introduced into the regenerating-cell circuit to serve as an ampere-hour meter and permit quantitative determination of the efficiency of replenishment. The data obtained in this engineering test are presented in Table V. The salient features are as follows:

(a) An initial lack of balance between the plating and replenishing processes, manifested by a slow drop in *p*H during the first 19.5 hours of the test, was readily corrected by simply increasing the ratio of the replenishing current to the plating current.

(b) The loss in nickel content of the electrolyte at the end of the 48-hour run was small, probably little more than that caused by spray loss. However, the fact that there is a copious evolution of gases in both plating and replenishing cells is a disadvantage of the process. Spray losses can be minimized by careful cell design, and plating-cell spray losses have been very small in plating the inside of tubes.

(c) The current efficiency of the regenerating process was 48 per cent. At first glance this seems to indicate a high power cost, but owing to close spacing of the electrodes the tank voltage is much lower than that used in plating. The measured power consumption of only 0.78 kwhr per pound of nickel dissolved represents a power cost of only a few cents per pound. This is small compared with the premium paid for nickel purchased in the form of nickel carbonate, which is selling at present at a price representing a nickel cost almost twice that of nickel in anode form.

(d) The cathode current efficiency in the plating cell was only 68 per cent, but it must be remembered that this was at a current density of only 40 asf (4.3 amp/dm²) and should be higher at higher current densities.

Tensile Properties of Deposits

Sheet-metal tensile-test pieces similar to A. S. T. M. standard specimens[9] but 6.25 inches (15.8 cm) long x 0.5 inch (1.27 cm) wide with a reduced section 2.25 x 0.25 inch (5.7 x 0.63 cm) were machined from the nickel deposits produced in the experiments described in Tables IV and V. The surfaces of the specimens remained in the as-plated and stripped condition.

The data of Table VI show that the nickel deposited from a chloride-free electrolyte did not differ much in properties from Watts-type nickel. It was a little harder and stronger and almost as ductile.

It was discovered that the nickel deposits from the insoluble-anode cell became embrittled upon annealing. This effect was explained when it was learned from analysis that there was 0.047 per cent lead in the deposits described in Table IV and 0.038 per cent in those referred to in Table V. This was not in accord with results achieved in commercial units, and hence it is believed (1) that lead anodes introduce appreciable amounts of lead into the electrolyte when they are freshly installed and (2) that a brown film which forms upon them with continued use reduces the lead contamination to innocuous levels. Evidence supporting this idea was found in the record of analysis of the electrolyte used in the test reported in Table V. This showed that the lead content was rather high at the start of the test period, namely, 7.8 ppm, but was only 0.4 ppm at the end.

Plant Design

In plans for a practical plant to operate with insoluble anodes, the design of the plating cell will differ according to the application. Provision should be made for means to reduce the amount of spray generated by the gases set free in both cells or to withdraw such spray by tank ventilators and possibly

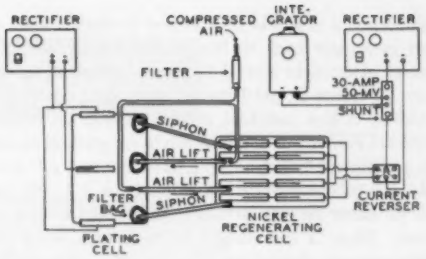

Fig. 5. Diagrammatic sketch of apparatus for regenerative plating

reclaim the entrained nickel salts. In the regenerating tank the nickel electrode area should be made as large as feasible without magnifying overhead charges. Electrode spacing should be very close, perhaps not more than 1 inch (2.5 cm) clear, and this practically necessitates that baffles be provided to force the circulating electrolyte to flow between the parallel faces of the electrodes. Because the cell voltage is less than 1 volt, owing to close spacing and low current density, a series-parallel arrangement of the electrodes is indicated to permit efficient use of a 6-volt source of direct current. In this case care must be taken in the design of the regenerating tank to avoid losses caused by current leakage along the sides and bottom of the tank. A simple way to do this is to divide the regenerating tank into compartments and connect the several compartments in series.

Rate of Circulation

The circulating system for electrolyte would normally operate as follows: depleted electrolyte from the plating tank would flow directly to the regenerating

TABLE VI. MECHANICAL PROPERTIES OF NICKEL DEPOSITS FROM PLATING CELL

Metal from Table	Specimen No.	Thickness inch	Hardness* VHN_{10}	Tensile Measurements		
				Ultimate Strength psi	Elongation, % in	
					1 inch	2 inch
IV	3	0.033	167	76000	25	18
	5	0.033	162	78000	29	19
	6	0.036	160	77000	30	19
	Ave.		163	77000	28	19
V	1	0.049	190	67300	..	22
	2	0.041	170	64000	..	27
	Ave.		180	65700	..	25
Watts Bath†	Ave.	0.031	137	62800	31	..

*Hardness measured on last-plated surface with Vickers diamond pyramid indentor and 10 kg/ load. Average of several readings.

†Average values from E. J. Roehl[10].

tank, whence it would be pumped through a filter and heat exchanger back to the plating tank. Volume of flow of electrolyte should be great enough to avoid a large difference in *p*H between incoming and outgoing solution. A flow rate high enough to keep the decrease in nickel content of the electrolyte on passing through the plating cell below about 0.08 oz/gal (0.6 g/l) would hold the *p*H differential within about 0.3 *p*H unit* and probably be satisfactory from an operating standpoint. Thus, if the current in the plating tank were 3,000 amperes, depositing 5 lb (2.3 kg) nickel per hour at 70 per cent efficiency, then the electrolyte should be circulated at the rate of at least 17 gal/min in order to limit the drop in nickel content to 0.08 oz/gal or less.

Electrode Area and Current Reverser

If sufficient electrode area is provided in the regenerating tank, say at least 200 ft² (18 m²) *total* electrode area for each pound (0.45 kg) of nickel to be dissolved per hour, then it will be possible to control the *p*H and nickel content of the circulating electrolyte by simply varying the total current in the regenerating unit, raising the current to raise the *p*H and nickel content and vice versa.

Design of the mechanism needed to provide periodic reversal of the replenishing current on a large scale is not within the scope of this report, but the authors understand that such equipment will soon be available commercially.

Conclusions

1. An electrolytic replenishing method has been devised for maintaining the nickel content and *p*H of a chloride-free nickel plating bath which is concurrently being depleted by nickel plating with insoluble anodes.

2. In the regenerating tank the anodic efficiency must be greater than the cathodic efficiency. This is accomplished by insuring high anode efficiency through periodic reversal of the current.

3. Current density and acidity levels optimum for the efficiency of the complete plating and replenishing cycle are indicated. With a plating cell operating at 40 asf (4.3 amp/dm²) the regenerating cell can be run at 10 asf (1.1 amp/dm²) to hold the *p*H at about 1.5.

4. Power costs for the regenerating tank are small because it can be operated with a close electrode spacing, a low current density, and a series-parallel electrode arrangement.

5. As-plated nickel deposits from the chloride-free bath show normal tensile properties and hardness.

6. A disadvantage of this process is that gases are copiously liberated at the various electrodes and cause considerable spray.

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Discussion

Dr. Wesley: I should like to discuss two references which have appeared since our paper was submitted to the Society:

First, A. W. Hothersall and G. E. Gardam have recently presented a paper to the Electrodepositors' Technical Society on "The Electrodeposition of Nickel in the Bores of Tubes Using Insoluble Anodes". This process was used successfully in England before and during World War II to line the inside of steel tubes 4 inches in diameter and up to 16 feet long with nickel deposits 0.05–0.5 inch thick.

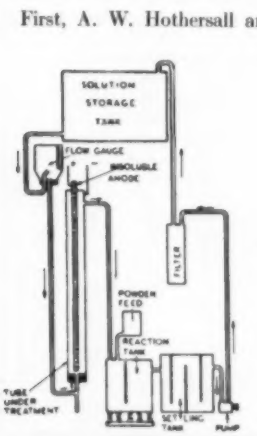
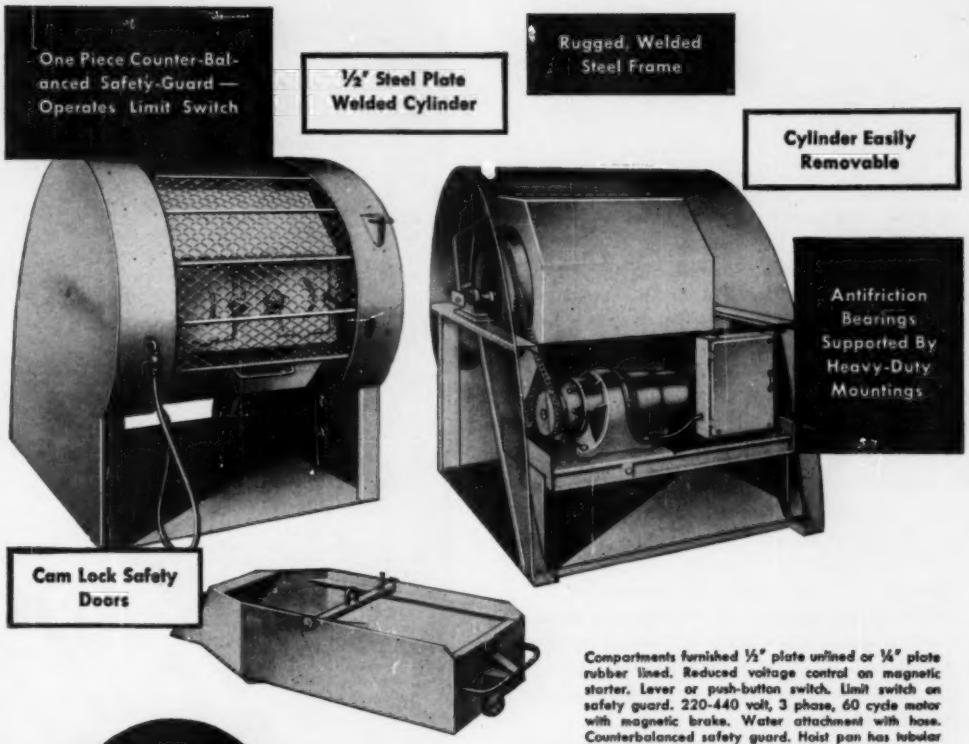


Fig. 6. Diagram of Hothersall-Gardam solution circuit

Hothersall and Gardam's diagram of the solution circuit is shown in Fig. 6. A chloride-free solution flows from a storage tank through a flow gauge, up through the tube being plated, then into a reaction tank, where very pure nickel hydrate powder is added mechanically as needed to maintain a constant *p*H. Having passed through a settling tank the electrolyte is pumped through a pressure filter back into the storage tank.

The authors give many operating details so that anyone contemplating application of an insoluble-anode process will do well to read this paper carefully to avoid making mistakes. For example, it is shown that it is important to have the electrolyte flow upward through the tube at a definite rate different for each size of tube treated; otherwise, there may be a

*0.08 oz/gal (0.6 g/l) Ni is equivalent to 0.13 oz/gal (1 g/l) H_2SO_4, which in turn is the amount of acid required to lower the *p*H of this bath from 1.6 to about 1.3.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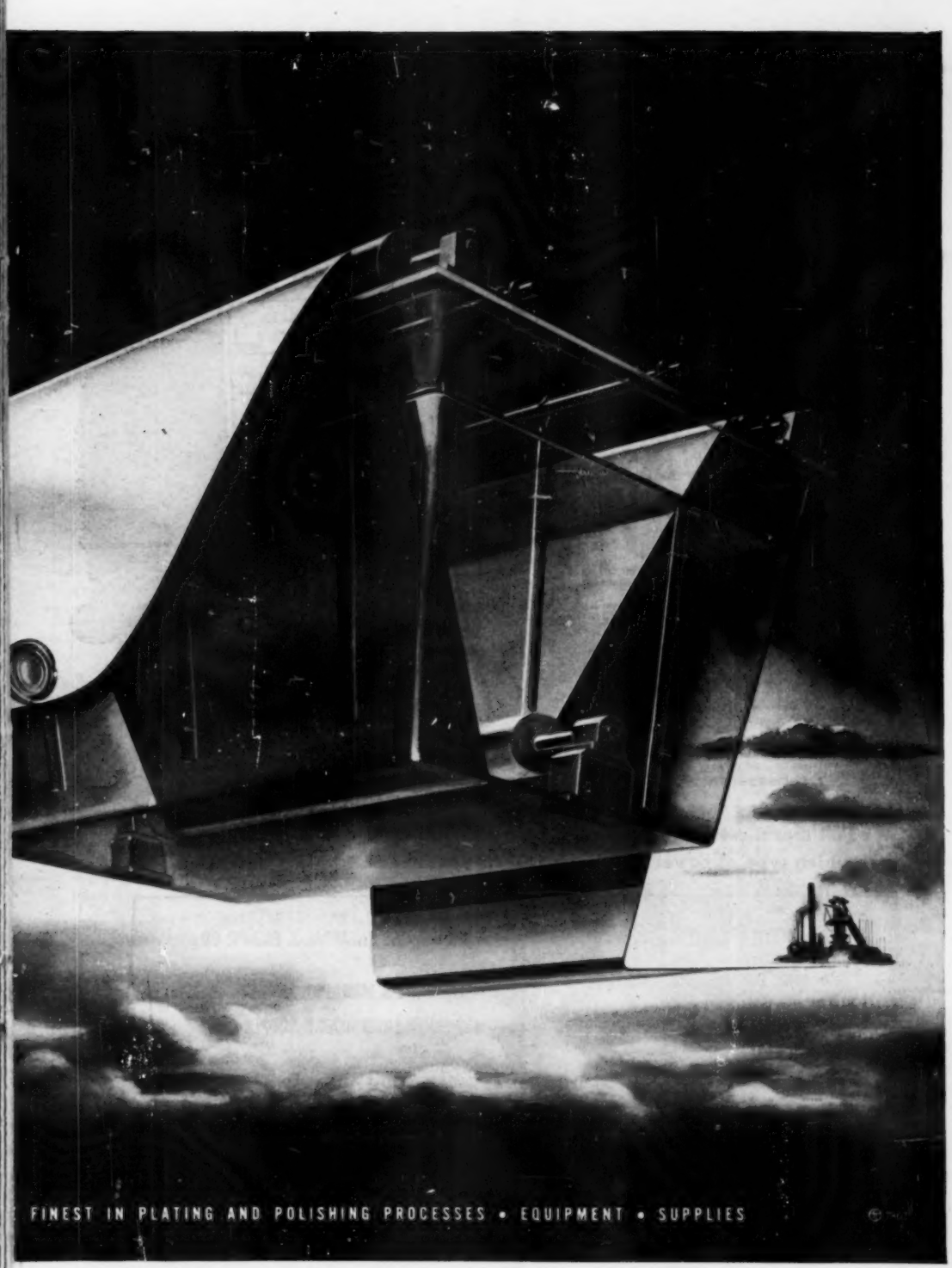
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marked difference in the thickness of the deposit from bottom to top of the tube.

The second reference is U. S. Patent No. 2,541,721 of February 13, 1951, assigned to The International Nickel Company, Inc., which covers the insoluble-anode procedure described in the present paper.

Dr. H. J. Wiesner (Bendix Products Division, South Bend, Ind.): Is any anti-pit agent used in this process?

Dr. Wesley: No. The oxidation effcet at the insoluble anode is so great that we presume that it takes care of any substance tending to cause pitting. There is evidence in some work published in England that actually some persulfate is produced at the anode, which probably would work as efficiently as peroxide. (See the reference to Hothersall and Gardam.)

Dr. A. Brenner (National Bureau of Standards, Washington, D. C.): Did you try the technique for regeneration based on the use of a very small cathode? It is well known that if a small cathode, for example a wire, is used in a nickel plating solution at a very high current density, no nickel will deposit. Instead the *p*H of the solution will be increased in the neighborhood of the cathode. By this means, one can cause an anode to dissolve without depositing metal on the cathode. This technique works particularly well in the presence of hydrogen peroxide in small concentration. We have used this technique on a small scale in A. E. S. Research Project No. 9 for raising the *p*H of a nickel bath without adding solid materials to the bath.

Dr. Wesley: We did try that on a small scale, but concluded that it was not as practical as an engineering device because the power cost would be very much higher. That was the only reason.

Mr. Joseph B. Kushner (The Joseph B. Kushner Electroplating School, Stroudsburg, Pa.): Was any attempt made to refrigerate the cathode? It is a well-known fact that efficiency drops considerably with refrigeration of the cathode.

Dr. Wesley: That sounds like a very clever idea; we will try it.

Ultrasonic Cleaning Device

Cleaning tiny openings in electric-shaver heads, long a major problem in the electric-shaver industry, is now being successfully accomplished by the use of an ultrasonic cleaning device specially designed for this purpose by the General Electric Company's General Engineering Laboratory at Schenectady, N. Y.

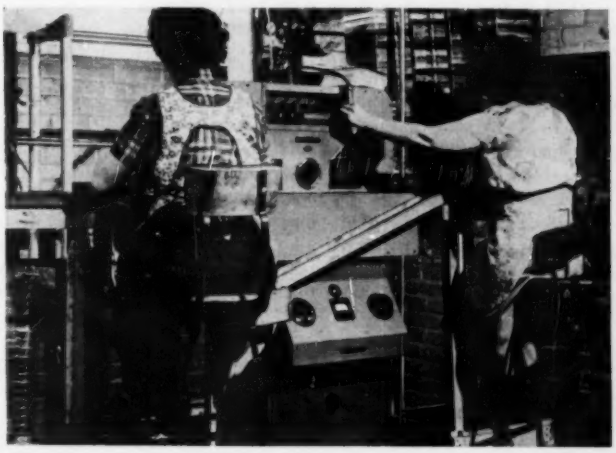
Officials of Schick, Inc., Stamford, Conn., manufacturers of electric shavers, where the experimental cleaning device is in use, report that operating costs have been cut 58 per cent. The ultrasonic unit requires only 12 sq ft of floor space, one-third of that required by Schick's previous cleaner.

Compounds used in grinding the parts, as well as metal particles, become lodged in the small corners and capillary spaces of the shaver heads, making cleaning by ordinary methods difficult. The new method of cleaning simplifies the operation and eliminates brushing of each tiny opening, thus speeding the operation and cutting expense.

The G-E ultrasonic generator, a major component of the new device, converts electrical energy into sound energy, at a frequency within the radio-broadcast band. The soundenergy is then transmitted through a cleaning solvent through which the shaver heads, mounted on a moving chain, are conveyed. As the parts pass through the activated field, grease, oil, metal shavings, and lapping compound are removed.

The machine's RF generator supplies high-frequency voltage to a quartz crystal which, vibrating at its resonant frequency, generates sound waves in the liquid (saline solution) in contact with its upper face. These waves then pass through a thin diaphragm into the cleaning solvent where the cleaning action takes place. The sound waves are said to do the most thorough cleaning job of any method yet devised.

The device is easily regulated by simple controls, and is electrically interlocked for safety of operation.



Experimental ultrasonic cleaning device in pilot operation at Schick Shaver, Inc. The lower section of the cabinet is an ultrasonic generator which transmits sound waves through the cleaning solvent in a trough above, through which shaver heads are conveyed for cleaning. Operator at left loads the continuous conveyor, worker at right removes cleaned heads from belt and places them in trays

ELECTROPLATING of Gold Alloys

EDWARD A. PARKER

Technic Inc., Providence, R. I.

(Continued from the November issue)

Alloy Solutions

Before details peculiar to each general type of alloy bath, for yellow, Hamilton, pink, green, white and antique golds, are discussed it is in order to define and discuss some of the terminology used in this field.

Twenty-four karat, of course, refers to pure gold, lower karats to gold alloys, e. g., 18K to 18/24, or 75 per cent, of gold, and 14K to 14/24, or 58.4 per cent, of gold. Usually a color is also designated, such as yellow, white, or pink. These remarks apply to solid or cast alloys.

Gold-filled and rolled-gold plate refer to base metals covered with thin layers of gold alloys. The usual method of manufacturing them is to hard solder or weld a sheet of gold alloy to a much thicker sheet of base metal (copper, brass, nickel-silver, or sterling) and then roll to the desired thickness. Such designations as 1/10, 1/20, and 1/40 refer to the weight proportions of gold alloy to the total weight of base metal plus gold alloy. Thus 1/20 12K gold filled denotes a bimetal strip containing 1/20, or 5 per cent, by weight of a 12K (50 per cent) gold coating. Usually only a single face of gold alloy is used; on occasion, however, both sides are coated with gold alloy. For an item with a double coating, the designation 1/20 12K would denote a coating only one half as thick as for a single-face item.

The karat designations are also used for electroplated alloys. However, they *refer only to the color of the plate* and not to its actual composition. Usually a 14K pink-gold electroplate will analyze 18–20K gold, and a 10–18K yellow-gold plate will assay 20–23K.

General Bath Composition

The following is a general formula for alloy baths:

Gold, as $KAu(CN)_2$	0.6–1.2 g/l (1.5–3 dwt/gal)
Free cyanide, NaCN	3–15 g/l (½–2 oz/gal)
Base metal	to color
Disodium phosphate cryst.	15–30 g/l (2–4 oz/gal)
Agitation	none
Voltage	3–5 volt
Temperature	140–160° F (60–71° C)
Time	10–120 sec
Anodes	stainless steel, 2 x cathode area

The colors produced in this type of solution are similar in tone to the rolled-gold plates. So-called "richer" colors may be obtained by increasing the gold content of the bath.

Pink Golds

The standard pink golds have lost consumer interest. For the most part this was caused by the overindulgence of strong pink or red colors during the late war years. In addition, most of these colors had poor wear and tarnish resistance, because of the high copper content of the so-called pink golds, copper being essentially the only source of pink color in gold alloys.

Plating conditions which tend to introduce a pink cast to gold deposits (in absence of copper) are high

temperature, high alkalinity, high current density, and organic contamination. It is believed that the pink-to-red tone produced under these conditions is caused by inclusion of basic salts of gold. A slight increase in time of plating under these conditions will always result in a soft plate with an uneven color, and on still longer plating a smut is obtained. Many of the deep-orange-to-rose 24K plates are obtained by these means from gold solutions containing no copper.

If copper is present all these conditions are favorable to the more rapid deposition of copper.

In a binary-alloy solution of copper and gold, the color of the plate changes rather abruptly from yellow to a decided pink as the copper content is gradually increased. The presence of one or more additional metals allows a rather broad transition stage from yellow to pink.

Analysis of many plates has demonstrated that the first pink cast to the plate begins to appear in the range of 19–19.5K, or approximately 80 per cent of gold.

A typical analysis and operating conditions for a gold-alloy solution which is being used for the production of thin plates (less than 0.000,005 inch; 0.13 μ) of a sun-tan or coral tone is the following:

Gold, as $KAu(CN)_2$*	0.82 g/l (2 dwt/gal)
Copper, as $K_2Cu(CN)_3$*	1.3–1.6 g/l (0.17–0.21 oz/gal)
Nickel, as $K_2Ni(CN)_4$*	0.1–0.25 g/l (0.013–0.033 oz/gal)
Free cyanide, NaCN	5–7 g/l (0.6–1 oz/gal)
Disodium phosphate, $Na_2HPO_4.12H_2O$	10–15 g/l (1.3–2 oz/gal)
Temperature	130–150° F (54–66° C)
Current density	20–40 asf (2.2–4.3 amp/dm^2)
Agitation	none
Anodes	stainless steel, 2 x cathode area
Aging	thorough

The voltage drop across one such 25-gal (95-l) solution with a sodium carbonate concentration of 1 oz/gal (7.5 g/l) and the stainless-steel tank as the anode was 6 volts. The current efficiency of this bath is approximately 6 per cent with respect to gold.

Such a bath would analyze approximately 35 per cent gold, or 8-9K (based on metal content). The replenishment of metals is on the basis of 80 per cent gold, or 19K. Regular additions of 8 g (5.1 dwt) of gold, 1.8 g (1.2 dwt) of copper and 0.14 g (0.09 dwt) of nickel were made to the aforesaid 25-gal (95-l) tank after each 22 amp-hr of plating.

The above-mentioned solution gives a plate with a slightly pink tone; when a redder color is desired it is necessary to double the copper content. Fig. 5 in the section on free cyanide (p. 1137) should be consulted for more details on the amount of copper necessary to produce a pink or red at a given free-cyanide concentration. In fact, the free-cyanide content is one of the more important factors in the operation of pink-gold solutions.

A solution which has had considerable popularity for basket plating of collar buttons and similar small items and its operating conditions are as follows:

Gold, as $KAu(CN)_2$	0.2 g/l (0.5 dwt/gal)
Copper, as $K_2Cu(CN)_3$	0.4 g/l (0.5 oz/gal)
Nickel, as $K_2Ni(CN)_4$	4.0 g/l (0.53 oz/gal)
Free cyanide, NaCN	3.0 g/l (0.4 oz/gal)
Disodium phosphate, $Na_2HPO_4.12H_2O$	60 g/l (8 oz/gal)
Temperature	130–150° (54–66° C)
Tank voltage	depending on type of basket and size of load
Time	30–180 sec

The use of the same solution in a horizontal plating barrel would undoubtedly lead to more consistent results.

A somewhat similar formula in which palladium replaces approximately ¾ of the nickel has been given by Pritchard[21] for producing a sun-tan or coral color on optical goods.

One of the few papers which have presented original work on the effect of some of the variables in pink-gold solutions is that of Dole[5], who made a real contribution by applying ionization and diffusion theories to actual plating data on pink-gold solutions. In his summation Dole stated that *the gold plating current is controlled by the rate of diffusion of the complex gold cyanide ion*. His conclusion was based on the following observations:

1. Above 10–15 asf (1.1–1.6 amp/dm^2) an increase in current density had no further effect on the gold plating current.
2. An increase in free-cyanide concentration had no influence on the gold plating current.
3. An increase in temperature increased the gold plating current to the extent predicted by diffusion theory.
4. A two-fold dilution halved the plating current.

The *copper plating current is controlled both by diffusion and by the rate of ionization of the copper cyanide complex.* This conclusion was based on the following observations:

1. An addition of excess cyanide ion markedly decreases the copper plating current.

*In the form of standardized solutions.

2. An increase in temperature increases the copper plating current more than predicted on basis of diffusion.
3. The copper-to-gold plating-current ratio is much smaller than predicted on basis of diffusion.

This work covered only the temperatures 77 and 122° F (25 and 50° C), and it would be very much worth while to extend it to 180° F (82° C) so as to cover the usual commercial plating temperatures. Another factor which does not appear to have been taken into consideration is the effect of ageing. There is considerable controversy over whether a more stable copper-gold complex is formed on ageing. Other effects of ageing are the formation of cyanide-decomposition products which have considerable effect on the rate of plating of copper and gold.

Another complicating factor which should be studied in the same fashion is the addition of such other metals as nickel or silver, one of which is always present in commercial pink-gold solutions.

In some exploratory work on deposition of heavy coatings from a 14K solution, it was found that 15 g/l (2 oz/gal) of potassium cyanide prevented the formation of a pink gold at 12 asf (1.3 amp/dm²) even though the solution contained 8.2 g/l (1.1 oz/gal) of copper.

Low current density (one-half that listed in Fig. 5) and high gold concentration (twice that of Fig. 5) contributed materially to the prevention of a pink color. The plates (0.0003 inch; 7.5 μ) were brownish-red in color; on rubbing with moist bicarbonate they yielded excellent yellow colors, with less than 1 per cent change in weight. The current efficiency varied from 60 to 74 per cent in the current-density range of 12.5–2.5 asf (1.3–0.27 amp/dm²).

Yellow Gold

Light-yellow, or "watch-case", gold plates are in demand at the present time. The simplest solution contains, of the metals, only gold and nickel. All other white metals have been and are being used: cobalt, tin, silver, cadmium, and zinc. Another method of preparing a suitable solution is to add copper and then neutralize the pink color of the plate with an addition of a silver or cadmium salt. Zinc will also neutralize the pink color, but it does not have the ability (or disadvantage) of producing a green color when added in excess.

The simple addition of nickel or cobalt to bleach, or pale, the 24K gold color produces the best plate when tarnish and wear resistance are considered. It is, however, the most difficult to handle. The major drawback appears to be the very limited range of plate composition for a given yellow color. Thus, in a binary electroplate of gold and nickel, the presence of 10 per cent of the base metal will produce a white plate. Inasmuch as at least 10 different shades of yellow may be differentiated between 24K yellow gold and 21K white gold, the range of composition for a particular shade is quite narrow. Visually, however, the more yellow colors (22.7–24K) appear to be easier to control than the whiter colors.

In production, excellent results are being obtained when all work is properly racked, a sufficient volume of plating solution is used, and the composition of the solution is maintained within normal limits. It is not a solution for haphazard plating.

In addition to its use as a final color, plate from this type of solution has excellent properties as a preplate on brass or copper for the production of acid-test gold finishes. The usual acid-test specification requires that no chemical action take place within two minutes when 35 per cent nitric acid is placed on a clean gold plated surface. The test is essentially one for porosity. For many applications a good bright-nickel base will suffice. If, however, good wear resistance is desired, it is necessary to use a high-karat acid-resisting nickel-gold or cobalt-gold alloy on top of the nickel and then follow with a flash plate of the desired color.

Such low-karat alloys as pink golds, analysing 15K or less, are attacked by nitric acid and will not pass an acid test even if a nickel base is used.

During the late war, and since, millions of military insignia were processed in simple gold-alloy solution of this type to pass the Quartermasters Corps' acid test. Nickel electroplates could not be tolerated for two reasons, chiefly the shortage of nickel during the war and also the possibility of "raising the rank" when the gold plate was rubbed off on polishing, leaving a white color.

Simple, highly finished items, such as lieutenant's bars, required 30 seconds or less in the gold-nickel alloy solution; more complex items, such as the matte-finished eagle hat ornament, required 2–3 minutes' plate. All were then flashed in standard 24K baths for color.

It was necessary to preplate some items with a pale-pink-gold solution (14K color) in order to cover the various solders and combinations of metals present. Such a plate accelerated coverage and in the end reduced the overall cost of producing an acid-resistant plate.

Thus, all possible steps were taken that would reduce porosity and at the same time maintain or even lower the overall cost:

1. Double and triple plates to prevent the extension of any continuous pores to the basis metal.

2. Low-current-density plating. High-current-density plating would have liberated so much hydrogen that little or no metal would have deposited in the micro crevices or holes in the surface of the basis metal or at the junctures of two or more metals. Because of the resulting high *p*H of the cathode film, basic salts would have been included in the metal deposited at high current density.

3. Dilute solutions. Higher metal contents would, of course, have increased the rate of producing non-porous plates, but the cost would have risen expon-

entially, and also the loss by dragout would have been exceedingly heavy.

4. Addition of a small amount of another metal, i. e., nickel, to the regularly used 24K baths, together with a reduction in their gold content, to lower the cost still further and to produce a finer-grain plate of the desired color.

The use of the latter step has recently been extended to the production of heavy deposits, apparently of 24K (by color) but containing up to 1 per cent base metal. The working life of the solution is apparently longer, and the plates are brighter, cleaner, and denser.

In the realm of thinner plates (less than 0.000020 inch; 0.5 μ) it is quite probable that such additions have been made to 24K solutions, but only one reference reporting such usage can be found in the literature. Schapiro[23] reports that Gillette Safety Razor Company keeps 0.13–0.26 g/l (0.018–0.035 oz/gal) of nickel in the 24K solution (9 dwt/gal; 3.6 g/l gold) in order to maintain a bright, uniform color. Without the nickel there used to be about 20 per cent rejects due to streaking.

The following formula and its operating conditions are given only as an example of one of the light-yellow-gold plating baths. The color can be changed slightly or to a considerable degree as advantage is taken of the factors previously discussed.

Gold, as $KAu(CN)_2$	0.8–1.2 g/l (2–3 dwt/gal)
Nickel, as $K_2Ni(CN)_4$	0.4–0.8 g/l (0.05–0.11 oz/gal)
Free cyanide, NaCN	7–11 g/l (1–1.5 oz/gal)
Disodium phosphate, $Na_2HPO_4.12H_2O$	15 g/l (2 oz/gal)
Temperature	140–160° F (60–71° C)
Current density	20–40 asf (2.2–4.3 amp/dm²)
Tank voltage	usually 4–6 volt
Agitation	none
Anodes	stainless steel, 2 x cathode area

The cost is in the range of 30–60 cents per square foot for a 60-sec plate.

Hamilton Gold

The Hamilton golds are essentially "watch-case" golds. Originally, the color appeared yellow under artificial light, and had the barest pink cast when compared with a yellow gold under north light. In the past year or two, however, almost every shade intermediate between pink and yellow has been called Hamilton. The solution formulae are innumerable, from simple gold-nickel-alloy solutions to those containing four or five metals. In the more complex solutions, copper is added to produce a pink color, and then silver or cadmium is added to neutralize most or all of the pink. These solutions appear to produce deposits of uniform color over a broad current-density range, but the resulting plates usually have a low gold content and are therefore subject to rapid tarnishing.

The following formula and operating conditions with their wide ranges cover most of the Hamilton solutions which have been encountered during the past four years:

Gold, as $KAu(CN)_2$	0.8–1.6 g/l (2–4 dwt/gal)
Copper, as $K_3Cu(CN)_3$	0.5–4 g/l (0.07–0.5 oz/gal)
Silver, as $KAg(CN)_2$	0.05–0.5 g/l (0.12–1.2 dwt/gal)
Nickel, as $K_2Ni(CN)_4$	0–1 g/l (0–0.13 oz/gal)
Free cyanide, NaCN	0.01–15 g/l (0.001–2 oz/gal)
Disodium phosphate, $Na_2HPO_4.12H_2O$	15 g/l (2 oz/gal)
Temperature	130–160° F (54–71° C)
Current density	10–100 asf (1.1–16 amp/dm²)

They range from the so-called non-cyanide solutions to a pink-gold solution in which silver is used to bleach the pink color of the plate. The high concentrations of copper and silver are not to be recommended, however.

A procedure that has much more to recommend it is to make a standard yellow-gold solution such as that listed under "Yellow Golds". It may be necessary to add more base metal or change the operating conditions in order to approximate closely the desired shade.

For small baths (1–4 gal; 4–15 l) the higher gold concentrations would be recommended because the current densities are usually higher, owing to the close proximity of the work to the anodes.

In larger volumes, 10 gal (38 l) and up, it is possible to work at the lower limits. In such solutions most work is racked and evenly spaced, allowing slower and more uniform plating without materially raising the cost. In fact, it is usually possible to turn out better quality work at less cost in fully controlled systems.

After the desired depth of yellow has been reached, copper in the form of a standardized solution of sodium or potassium copper cyanide may be added slowly if a pink tone is desired, or silver or cadmium as its complex if a green tone is required. The solution should be "aged" after each addition.

Usually, however, these minor color tones are effected by the surface finish or "modulation" of the work. One had better test this point before attempting to produce the desired color on flat test plates.

Other factors which must be examined before other metals are added are temperature, current density and basis metal, including any preplate, such as nickel.

It is desirable to keep the amount of copper, silver, cadmium or zinc in the final electroplate at a minimum to prevent rapid tarnishing.

(To be continued)

Barrel Finishing

(*Continued from page 1248*)

With a decrease in chip size, better part isolation is obtained. This function of preventing parts from impinging and nicking each other is of particular importance with larger parts, softer materials, or parts that may be easily bent or distorted.

With a given load, the harder the metal being processed, the finer will be the finish. It follows, therefore, that larger chips can normally be used with harder metals.

It is true that harder parts will deburr in shorter time than similar parts of softer metal. Gears should always be hardened before tumbling as unhardened gears often will not deburr satisfactorily.

Use of compounds and cleaners

In almost all cutting down operations, a so-called cleaner or compound is used which serves multiple functions: (1) To lubricate the operation and prevent too rapid honing of flat surfaces; (2) to keep the abrasive from glazing over, i. e., to retain its cutting qualities throughout the cycle; (3) to keep the parts clean and bright, and (4) to give short-term rust protection. Where descaling is involved, a special descaling compound is used.

Many proprietary brands of cleaners and compounds are on the market, some of which are most effective in one type of operation whereas others are best suited in other types. Manufacturers of compounds, barrels, or abrasives are in a position to give useful advice on each individual case.

Proper rinsing

Many operators fail to realize the importance of rinsing and wonder why the finish on the part lacks lustre or why it discolors soon after removal from the barrel. They are inclined to blame the cleaner or to feel that the time cycle should be lengthened. Either one or both may be at fault, but thorough rinsing of the parts, the medium, and the barrel may be all that is needed.

If the operation is only one of cutting down, the easiest and quickest way to rinse both parts and medium is to dump the load into a hoist pan and flush it thoroughly with a stream of water from a hose before separation. However, an additional final rinse of the parts after separation is often advisable.

With the barrel empty, it then becomes a simple matter to give it a careful rinsing.

If a burnishing operation is to follow the cutting down, without a change in size or nature of the medium, it is not necessary to dump the load. Thorough rinsing is, however, essential before burnishing. The barrel is first drained of water by means of a perforated drainage door. It is then flushed several times with a good stream of water from a hose. Many operators fill the barrel with fresh water, insert the drainage doors, and revolve the barrel. This makes certain that no sediment will remain trapped at the bottom of the load.

When the rinsing has been completed, the barrel is filled with water to the proper level, and burnishing compound is added.

At the end of the burnishing cycle, rinsing is again necessary; but this time, it can be done after the load has been dumped. A further rinsing of the abrasive chips is advisable before they are returned to the barrel for the next load.

If the abrasive is soapy (slippery) after use with a burnishing compound, it should be rinsed in the barrel until the water is clean. The water should then be dumped, and the barrel should be run for five to ten minutes to prepare the abrasive for the next cutting down operation.

Following the use of an acid descaling compound, both the barrel and the abrasive should be neutralized by running for five to ten minutes with an alkaline soap or trisodium phosphate.

Ball Burnishing

Ball burnishing is not an abrasive operation and will not remove burrs, nor improve smoothness. It is designed solely to produce a high finish on either plated or unplated parts.

The fundamentals of ball burnishing differ little from those of cutting down with abrasive, so much so that much preparation for plating is now being done with small-size abrasive. Where the highest possible lustre is required, however, ball burnishing is a necessity.

The cardinal rule of this operation is that both balls and parts, as well as the barrel itself, must be scrupulously clean before the operation is started. Steel stampings and other parts are frequently given a dip in a hot caustic solution before they are burnished. Sometimes an acid bright dip is used on nonferrous parts, and at times a vapor degreaser may be used to produce the degree of cleanliness required prior to burnishing.

The length of run required varies somewhat with the type of parts being finished. Steel stampings seldom require a run longer than 1½ or 2 hours; in general, longer runs do not improve the lustre. Brass and copper parts, on the other hand, frequently respond with a brighter color in runs up to 4 or 5 hours. The length of the cycle depends entirely on the results required.

Some alloys of brass have a tendency to oxidize immediately after the burnishing operation. This can be corrected by giving the parts a dip in a mild cyanide solution after they have been burnished.

Care of the balls is of prime importance. It is not necessary to remove them from the barrel so that they can be dried when not in use. If the barrel and the balls are not to be used for a period of two or three days, the balls should be left in the barrel, in fresh water to which has been added several ounces of soap chips. The barrel should then be run for ten minutes

to dissolve the soap. This sudsy solution will keep the burnishing balls from rusting. When it is time to use the barrel again, the solution should be drained off and a fresh soap and water solution added for the actual burnishing operation. If the department is to be idle for longer than two or three days, the same procedure can be followed, but to the soap solution should be added a cupful or two of caustic soda. This will keep the balls from becoming rusty for weeks at a time. If the period of inactivity extends to several weeks, however, the water level should be inspected occasionally to see that evaporation does not bring the level of water down below the steel balls. Should that happen, it is quite likely that the balls might take on a coating of rust, and that would make them unfit for use as burnishing media until the rust had been thoroughly removed. Usually that requires an abrasive operation.

A mixture of cones with burnishing balls provides a good polishing medium. The purpose of cones, slugs, or any other burnishing shape is to assure contact in angles or corners that cannot be reached by a round ball.

In general, from two to three parts of burnishing balls are used to one part of work (by volume) with the average running close to two to one.

Conclusion

As can be seen, results in barrel finishing are secured by control of a combination of many variables. Just as no two jobs are alike, different results on the same job can be secured by a variation in one or more of the factors affecting it. For this reason, the operation cannot be reduced to an exact science. Even the expert must depend on a certain amount of trial and error to determine the exact technique that will produce the precise results required on a specific job. True, the expert, with his fund of experience, can more quickly arrive at a proper combination of all the variables, but seldom can he do it without at least one test run.

The less experienced operator, therefore, need have no hesitancy about insisting on some tests before final cycles are set. The intelligent newcomer to the field will do well to keep a careful record of every test he runs, with various shapes and sizes of parts and with different metals, so as to determine the reasons for success or failure. Only in this way can he build up, quickly and surely, the fund of knowledge necessary to approach each new job with confidence.

Acknowledgments

The author wishes to express his sincere appreciation to the many authorities on the techniques of barrel finishing who have given so generously of their time and experience in helping to develop this article. Special thanks are due Mr. H. V. Beggs, President, Metals Finishing Corporation, Detroit, Mich., and Mr. M. M. Maynes, Engineering Consultant, and Mr. W. J. Mahan, Tumbling Engineer, both of Norton Company, Worcester, Mass.

QUESTION BOX

readers' questions of general interest

Q. 129. In cleaning buffed brass plumbing fixtures with trichlorethylene, we are getting a powdered film on the work which we find very hard to remove before nickel plating. Do you have any suggestions as to how this film may be eliminated?

A. The powder remaining on the work after cleaning is from the solids in the buffing compound that is not completely removed during the cleaning process. Simple vapor degreasing usually extracts the organic portion of the dirt and flushes away some of the inorganic dirt, but in most cases a tenacious film of dust remains on the work that can be noticed in the subsequently applied plate. If trichlorethylene degreasing must be done, the use of clean solvent for flushing off the work is more effective for removing buffing compounds than simple vapor degreasing. However, in many cases, emulsion cleaners are more effective for removing both solid dirt and organic dirt.—W. R. Meyer.

Q. 130. We wish to standardize our surface finishes. Can you advise us of available standards?

A. The General Electric Company has a series of stainless-steel-block standards, each of a different degree of roughness. However, they do not go below 100 microinches, and hence do not apply to the metal-finishing field.

A working group within Committee B-8 of the American Society for Testing Materials is attempting to designate the quality of a surface numerically. So far this group feels that at least three dimensions will be necessary, namely, the optical reflectivity, the diffused reflectivity, and the surface roughness. Even with these dimensions, the group has not been able to set up standards. It is safe to say that there are no standards in the U. S. by which surface quality can be indicated.—G. W. Jernstedt.

Q. 131. Do you know of any volumetric method for determining sodium hydrosulfite in a copper cyanide plating solution, added to decompose chromic acid contamination? Is the hydrosulfite stable in the plating solution?

A. The sodium hydrosulfite is believed to be unstable in the copper cyanide plating solution, decomposing rather rapidly with precipitation of finely divided copper or copper sulfide, which causes shelf roughness. No need is seen for an analytical method.—K. G. Soderberg.

Washington Orders

Copies of NPA orders and publications may be obtained from National Production Authority, Washington 25, D. C., or from any of its local offices.

Appeals.—Some of the rules of the NPA appeals procedure were more closely defined in an amendment of October 11 to NPA Regulation 5.

Allotment and DO numbers and symbols.—A revised list was issued on November 6. New symbols are C-4 and C-5, for certain munitions items purchased by foreign governments and for Canadian military production programs, respectively. The programs identified by symbols X-5 and FC have been expanded. Symbol V-1 has been dropped and is now covered by M-1.

Availability.—Issue No. 3 of "List of Basic Materials and Alternates" released on October 29 includes a new classification, "most critical", under materials in short supply. Under this classification are found, among others, copper, lead, selenium, tin, zinc, cobalt, nickel and tungsten. Carbon bisulfide, copper chemicals, hydrofluoric and orthophosphoric acid, and selenium compounds are now "in short supply", whereas hydrog n peroxide is "in approximate balance".

Business Advisory Service.—This service has now been moved to Room 2-N-6 on the second floor, main corridor, of the new GAO Building. It will handle both personal and telephone calls (Sterling 5200, Extensions 5381-5).

Carbon disulfide.—See sulfuric acid.

Copper.—Direction 2 to NPA Order M-11 was amended on November 2 in an effort to help users in placing orders with their traditional suppliers. Producers (1) may now accept up to 100 per cent of their monthly authorized production in CMP orders; (2) must give prompt notification of acceptance or rejection of orders; and (3) will open their order books for a quarter not later than 90 days before the first day of the quarter.

Supplementing the restrictions in Order M-47B, Order M-47A as amended on October 11 retains indefinitely the prohibitions on the use of copper for decoration and ornamentations that were in force during the third quarter. The prohibition does not apply to end products that are primarily ornamental or decorative and that are not attached to or used as part of another end product.

Inventories.—NPA Regulation 1 was amended on October 22 (1) to include a long list of metals, chemicals, plastics and other materials; (2) to provide a more specific definition of items in inventory and to include many materials formerly classed as "in process"; and (3) to list by material all other inventory controls in NPA orders and regulations.

Lead.—With the amendment of Order M-76 on October 29, imported pig lead is now under the same allocation procedure as domestic lead.

Nickel and cobalt.—All nickel and cobalt supplies on this side the iron curtain are now being allocated to the 32 anti-communist nations. The U. S. has been assigned 62 per cent of the nickel and 56 per cent of the cobalt. The success of the arrangement depends on voluntary cooperation among the participating countries; no penalties are provided for violation.

Small business.—On October 15 the Office of Small Business in the NPA instructed the 115 field offices of the Department of Commerce (1) to locate small plants suitable for subcontract work; (2) to contact prime contractors, encourage them to subcontract, and advise them of available facilities; (3) to maintain inventory of small-plant facilities in cooperation with local groups; (4) to advise small business about Government procurement; (5) to provide for the assembly and effective use of existing facilities records; (6) to assist Government procurement officers by locating needed outside procurement capacity; (7) to handle and forward to proper authority complaints by small business; (8) to maintain contact with Government procurement personnel to insure implementation of Government procurement policies with respect to treatment of small firms; (9) to provide counsel on formation of production pools.

Sulfuric acid.—Restriction on the production and certain uses of sulfuric acid, including synthetic detergents, (and of carbon disulfide) are expected in order to conserve sulfur.

The Electroplating Industry in Atlanta

The following communication emanates from one of the oldest and largest job-plating shops in the South. It shows the plating industry in Atlanta, Ga., in a much better light than an earlier article on this subject, and explains the apparent reasons for the discrepancy.—Editor.

"Dear Sir:

"Mr. Victor J. Baran, in his article on this subject in the March and May issues, used information that he had obtained from others, the result being that he was misinformed, because he went to the wrong sources.

"Our firm was never contacted, and we know a great deal about the plating situation in our section of the country. It appears that most of the information Mr. Baran did obtain come from the other side of the fence, that is, the manufacturers desiring to have plating done.

"Up to the beginning of World War II there were no great requirements for electroplating in the South. Under such conditions it was not economical to invest a great deal of capital in electroplating facilities, and no real progress was made in the scientific end of plating in our region. Another condition that was prevalent before World War II was that when some small organization would develop an article that required plating, it was immediately desirous of doing a complete job, including the plating. In addition, many of those who used job shops thought that plating was only dipping in and out and that any price charged was exorbitant.

"The point that I am trying to make is that industry in the South was small and never helpful in developing good, healthy plating shops.

"During the war period and later, the picture has changed somewhat in the South; there is more demand for plating, and all of us in the job-shop business are making some progress. Hence, I consider Mr. Baran's article untimely and out of date. His article would possibly have been in order previous to 1940.

"His reference to pricing of articles is inconsiderate. We know of many cases where manufacturers want production price but cannot guarantee any definite quantities. Unless Mr. Baran could have checked back and studied the reason for excessive pricing he could not possibly have had a correct picture.

"As to advertising, I am of the opinion that our concern does as much advertising (based on volume of business) as any plating concern in the country.

"The figures obtained by Mr. Baran are incorrect, and the article does not exemplify the situation in the job plating business. It is possible, however, that Mr. Baran was not given the cooperation needed in order to compile a more nearly correct story on the plating business in the South.

"I will consider it a great favor if you will make reference to the articles on the electroplating industry in Atlanta appearing in your March and May, 1951 issues and explain that it was unfortunate that Mr. Baran did not allot himself more time in order that he could examine all sides involved before having his article published".

Louis Rosenberg
Simmons Plating Works, Inc.
Atlanta, Ga.

project no. 12

project director:
HENRY B. LINFORD*

associate:
EDW. B. SAUBESTRE*

location:
COLUMBIA
UNIVERSITY,
NEW YORK CITY

Acknowledgement is due the Research Committee, Dr. W. A. Wesley, The International Nickel Company, Chairman; the Research Directing Committee, Mr. G. M. Cole, Fernstedt Division, General Motors Corporation, and Dr. Donald Price, Oakite Products, Inc., Chairman and Vice-Chairman, respectively; and the Project Committee, Mr. E. T. Candee, Lea Manufacturing Company, Chairman; Dr. W. A. LaLande, Jr., Pennsylvania Salt Manufacturing Company, and Dr. Edward Parker, Technic, Inc., for their contributions to this project.

*AUTHORS

Cleaning and Preparation of Metals for Electroplating

IV. DEGREASING EVALUATION TESTS: SEQUENTIAL TESTING

(CONTINUED FROM THE NOVEMBER, 1951 ISSUE)

TABLE OF CONTENTS

3. Results 1263
(a) Cleaning Conditions 1263
(b) Tabulated Results and Correlations 1264
(c) Discussion 1264
4. Sensitivity 1265
(a) Method of Determination . . . 1265
(b) Results 1266
(c) Conclusions 1266

3. Results

(a) *Cleaning Conditions*

Range.—In the previous paper[10a, f] dealing with the atomizer test, cleaning conditions which permitted a study of panels over a wide range of cleaning indices from 0 to 100 were presented. As the sequential tests necessitated the compiling of very large amounts of data, it was decided, for the sake of convenience, to select three different cleaning conditions. These three conditions are described in Table IV.

Blank runs.—Before the sequential tests were run on panels cleaned at the conditions indicated in Table IV, it was necessary to establish the fact that, in all of the degreasing-evaluation tests, the cleaning index would really be 100 in the absence of residual oil. For this purpose, panels soiled in lard and mineral oils were cleaned at 100° C for 20 minutes. Four runs were made with each oil (i. e., 12 panels, with duplicate readings for each of the six sequential series). In all the tests, the cleaning index was 100 in all cases. No water-break was observed. In the gravimetric test, the amount of soiling detected was 0.0000g ± 0.0001.

Pattern types.—The patterns obtained with the atomizer test have been presented previously[10a]. With the other evaluation tests, the patterns obtained at each cleaning condition were similar to one another. For lard oil at 70° C for 3 minutes, the pattern consists of a few relatively large, irregularly shaped areas of oil, with many small globules of oil scattered about the surface. For lard oil at 70° C for 10 minutes, and mineral oil at 40° C for 3 minutes, the patterns consist of a number of comparatively small globules of oil.

TABLE IV. CLEANING CONDITIONS

No.	Oil	Cleaning		Amount of Soil	
		Temp °C	Time min	Original mg	Final mg
1	Lard	70	3	128.5	67.6
2	Lard	70	10	128.5	7.6
3	Mineral	40	3	97.2	3.2

(b) *Tabulated Results and Correlations*

Table V presents some of the salient results obtained with the sequential tests. Table VI correlates atomizer-test results with the percentage of the panel area that appears to be free of any evidence of oil globules in the fluorescent-dye test. The results obtained upon individual panels are presented in Appendix (e).

(c) *Discussion*

Examination of Table V will show that for all three cleaning conditions investigated, the atomizer test gave by far the lowest value for C.I., the fluorescent-dye test a considerably higher value, and the spray-pattern, copper-dip, and KFC tests still higher values. These results are strikingly illustrated in the bar graphs of Fig. 3. They indicate quite clearly that when panels which have been alkaline cleaned are tested prior to plating any deficiencies in the removal of oil are most strikingly demonstrated by the use of the atomizer test. The fluorescent-dye test appears to be next best in revealing the presence of residual oil, but, of course, it requires a particular type of soil, some apparatus, and a suitable dark room, and thus is none too convenient to carry out as a spot-check, as contrasted with the water-break-type tests. The spray-pattern, copper-dip, and KFC tests all give approximately the same results at all the cleaning conditions, with the order of sensitivity within this group being spray-pattern, KFC, and copper-dip.

In the case of lard oil, the fluorescent-dye test appears to come closest to indicating the true oil distribution on the surface, the only error arising from a slight tendency to spread during testing. With the copper-dip and KFC tests, there is a marked tendency to "bridge over" very small oil droplets, and to "plate-under" very thin residues and the outer edges of slowly spreading globules, thus limiting sensitivity. In the spray-pattern test, failure of the test occurs not only at the site of the visible part of the oil globule but also for some distance around the globule, especially near the top area of the panel where the test is more sensitive. Comparison of pantograph tracings with fluorescent-dye photographs shows that, in this test, the smallest globules of oil generally escape detection if they are isolated on an otherwise clean surface. The atomizer test, as was discussed previously[10e, f], will reflect large areas of water-droplet formation, i. e., of apparent contamination caused by the presence of only very small residual oil globules, accounting for the very low C.I. values, and hence for its sensitivity.

With mineral oil, spreading of oil during the course of testing is so excessive that the fluorescent-dye test results do not reflect accurately the areas originally covered by oil droplets. One mitigating factor, however, is that this very spreading so dilutes very small globules as to render them invisible in the photographs. Hence, the two sources of error tend to cancel out. This spreading of mineral oil does not greatly affect the results of the

TABLE V. SEQUENTIAL TEST RESULTS

Sequential Series	I			II			III			IV			V			VI			Average		
Test	$\bar{X}$	σ	n	$\bar{X}$	σ	n	$\bar{X}$	σ	n	$\bar{X}$	σ	n	$\bar{X}$	σ	n	$\bar{X}$	σ	n	$\bar{X}$	σ	n
Lard Oil — 70° C — 3 min																					
1. Water-break (sec)	0	0	4	0	0	3	0	0	3	0	0	4	0	0	4	0	0	3	0	0	21
2. Spray-pattern	84.1	3.9	4	83.2	8.6	3	85.5	5.3	3	.....			.....			.....			84.3	5.3	10
3. Atomizer	.....			.....			.....			6.6	2.4	4	7.9	2.9	4	15.3	6.7	3	9.5	5.3	11
4. Fluorescent-dye	.....			.....			58.1	11.0	3	46.6	3.2	4	.....			52.1	1.7	3	51.7	7.5	10
5. Copper-dip	87.6	6.1	4	.....			.....			.....			89.2	3.1	4	89.7	8.2	3	88.7	5.3	11
6. KFC	.....			90.2	5.9	3	.....			82.2	8.4	4	.....			.....			85.6	8.0	7
7. Gravimetric	.....			.....			.....			.....			.....			.....			47.4	3.5	6
Lard Oil — 70° C — 10 min																					
1. Water-break (sec)	0	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	24
2. Spray-pattern	95.4	1.7	4	94.6	3.4	4	93.3	6.6	4	.....			.....			.....			94.4	4.1	12
3. Atomizer	.....			.....			.....			16.9	6.3	4	21.0	12.0	4	31.5	4.7	4	23.1	9.8	12
4. Fluorescent-dye	.....			.....			85.2	3.1	4	84.1	3.3	4	.....			86.4	6.1	4	85.2	4.1	12
5. Copper-dip	98.8	0.3	4	.....			.....			.....			98.5	0.6	4	97.7	1.1	4	98.3	0.8	12
6. KFC	.....			97.2	0.8	4	.....			96.1	2.8	4	.....			.....			96.6	2.0	8
7. Gravimetric	.....			.....			.....			.....			.....			.....			94.1	1.5	6
Mineral Oil — 40° C — 3 min																					
1. Water-break (sec)	0+Inf.	0	4	0+Inf.	0	4	0+Inf.	0	4	0+Inf.	0	4	0+Inf.	0	4	0+Inf.	0	4	0+Inf.	0	24
2. Spray-pattern	98.3	0.3	4	95.0	0.9	4	93.4	3.0	4	.....			.....			.....			95.6	2.7	12
3. Atomizer	.....			.....			.....			43.6	3.2	4	44.0	9.1	4	35.4	8.0	4	41.0	7.4	12
4. Fluorescent-dye	.....			.....			87.1	6.2	4	86.9	8.8	4	.....			78.0	2.8	4	83.9	7.4	12
5. Copper-dip	98.5	1.0	4	.....			.....			.....			98.0	1.3	4	98.3	0.5	4	98.3	0.9	12
6. KFC	.....			97.5	1.4	4	.....			99.2	0.8	4	.....			.....			98.4	1.4	8
7. Gravimetric	.....			.....			.....			.....			.....			.....			96.7	0.9	6

copper-dip and KFC tests (see Appendix (b)), owing to bridging and plating-under, and to a tendency for the copper solution to replace mineral oil on the panel surface. In the spray-pattern test, spreading is not a problem as the panel surface never dries. The remarks made above about this test with lard oil apply here as well, except that the tendency of the test to fail for some distance around the oil globules is much less pronounced. Likewise, the remarks made above about the atomizer test apply to mineral oil as well. Spreading is not too serious a problem here as only a brief air contact of the oil occurs.

An examination of the fluorescent-dye photographs reveals one rather remarkable connection with the atomizer test. If the area of the panel in the fluorescent-dye test which shows no evidence of residual lard-oil droplets be measured, it is found to check well with the atomizer-test results (see Table VI). This would seem to lead to the conclusion that the atomizer test registers clean areas only where no traces of oil droplets are present. However, the existence of even a few scattered small oil globules does cause water-droplet formation in the atomizer test. This correlation could be made only in the case of lard oil, because with mineral oil the smallest globules spread so thin during the course of testing as to fail to photograph, while somewhat larger globules spread until they covered a larger area on the photographic plate than was initially the case.

Appendix (b) expresses in terms of statistical criteria the quantitative correlations between the various degreasing-evaluation tests that have been discussed above qualitatively.

Examination of the sequential test results has shown that the C.I. results obtained by the different tests vary quite widely. These C.I. data can form the basis for an estimation of the relative sensitivity of the different evaluative techniques (see the following section). Before this is done, however, it is necessary to establish that the experimental procedures used have been adequate for obtaining reproducible results.

Examination of Table V will show that the value of σ varies from 0 to 9 in most cases. This compares acceptably with results obtained by others, such as Spring, Morgan, and Harris, in their investigations of metal-cleaning evaluation. All of the tests examined appear to have about the same values of σ. See Appendix (c) for a more detailed analysis.

4. Sensitivity

(a) *Method of Determination*

Oil is not removed uniformly from a metal surface during the course of alkaline cleaning. Rather, residual oil tends to be present primarily in the form of discreet, small globules. This being the case, it is evident that the work here presented cannot yield direct evidence on the ultimate sensitivity of the various tests. This can be done only by soiling panels uniformly with thin oil deposits and measuring the ultimate sensitivity (the results of such experiments will be reported upon in a later paper). However, sequential testing does permit the evaluation of equivalent sensitivity, that is, a measure of how readily any given test reveals the presence of residual oil globules. Even at the lowest range of residual oil tested here (equivalent to 38×10^{-6} g/cm²) all of the degreasing-evaluation tests register. This is in accord with the results obtained by Harris[73b]. The low range was deliberately so chosen because, for practical operations, what is desired is a test that will reveal readily the presence of any small globules remaining on the surface after completion of alkaline cleaning.

TABLE—VI. CORRELATION OF ATOMIZER AND FLUORESCENT-DYE TESTS
Individual panels

Atomizer Test C.I.	Fluorescent-Dye Test per cent of area which does not contain evidence of oil droplets
Lard Oil — 70° C — 3 min	
3.5	4.0
6.0	12.9
7.9	9.8
9.1	7.3
Lard Oil — 70° C — 10 min	
10.4	19.6
12.9	26.3
23.6	36.5
27.8	23.0

Equivalent sensitivity is determined as follows:

$$\frac{\text{Total Residual Oil}}{\text{Total Panel Area}} \times \frac{\text{Test Panel Area}}{\text{Apparent Soiled Area}} \times \frac{\text{Smallest Particle}}{\text{Apparent Soiled Area}} = \text{Equivalent Sensitivity}$$

$$\left(\frac{g/cm^2}{}\right) \quad \left(\frac{cm^2/cm^2}{}\right) \quad \left(\frac{cm^2/cm^2}{}\right) \quad (g/cm^2)$$

$$\text{Apparent Soiled Area} = \text{Test Panel Area} \times \frac{(100 - \text{C.I.})}{100}$$

Test Panel Area = 38.7 cm² (6 in²)
Total Panel Area = 83.9 cm² (13 in²)

The smallest particle observable with each test has been determined by a close examination of all the pantograph tracings and fluorescent-dye photographs. The values will be found in Appendix (d).

In the equation given above, the first term on the left is the over-all amount of oil left on the panel surface. The second term is a measure of the area covered by contamination on the test panel.

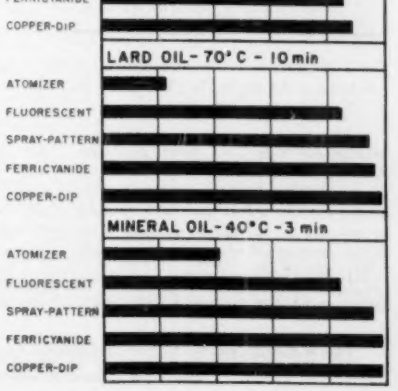


Fig. 3. Cleaning-index results for various degreasing-evaluation tests

TABLE VII. SENSITIVITY OF DEGREASING EVALUATION TESTS

Test	Residual Oil g/cm²	Equivalent Sensitivity g/cm²
Lard Oil—70° C—3 min		
2. Spray-pattern	805×10^{-6}	5.5×10^{-6}
3. Atomizer	805×10^{-6}	0.16×10^{-6}
4. Fluorescent-dye	805×10^{-6}	0.14×10^{-6}
5. Copper-dip	805×10^{-6}	5.3×10^{-6}
6. KFC	805×10^{-6}	3.2×10^{-6}
Lard Oil—70° C—10 min		
2. Spray-pattern	90×10^{-6}	4.8×10^{-6}
3. Atomizer	90×10^{-6}	0.03×10^{-6}
4. Fluorescent-dye	90×10^{-6}	0.17×10^{-6}
5. Copper-dip	90×10^{-6}	26.0×10^{-6}
6. KFC	90×10^{-6}	6.5×10^{-6}
Mineral Oil—40° C—3 min		
2. Spray-pattern	38×10^{-6}	3.3×10^{-6}
3. Atomizer	38×10^{-6}	0.02×10^{-6}
4. Fluorescent-dye	38×10^{-6}	0.49×10^{-6}
5. Copper-dip	38×10^{-6}	11.0×10^{-6}
6. KFC	38×10^{-6}	12.4×10^{-6}

Average

Test	Average Equivalent Sensitivity g/cm²	σ g/cm²	n
2. Spray-pattern	4.5×10^{-6}	1.3×10^{-6}	3
3. Atomizer	0.07×10^{-6}	0.06×10^{-6}	3
4. Fluorescent-dye	0.38×10^{-6}	0.19×10^{-6}	3
5. Copper-dip	14.1×10^{-6}	10.7×10^{-6}	3
6. KFC	7.4×10^{-6}	4.7×10^{-6}	3
7. Gravimetric*	1.2×10^{-6}	.....	..

*Sensitivity of the gravimetric test based upon assumption of a minimum reading of 0.1 mg on the 13 in² panel (83.9 cm²).

Multiplying these two terms gives the effective concentration of residual oil on the panel. The final term is the fraction of the existing soiled area which would be revealed by the test in question if all of the existing oil were removed, except for the smallest particle visible in the test. (The use of this term presupposes that the apparent soiled area is entirely oil covered. This is largely true for most of the tests, but is hardly correct for the atomizer test. Hence, this method of calculating equivalent sensitivity is not entirely satisfactory for the atomizer test.)

By substituting into the above, the equation reduces to the following:

$$\text{Equivalent Sensitivity} = \frac{\text{Total Residual Oil} \times \text{Smallest Particle}}{0.325\,(100 - \text{C.I.})^2} \left(\frac{\text{g} \times \text{cm}^2}{\text{cm}^4}\right)$$

(b) *Results*

The salient results obtained are found in Table VII. Further details appear in Appendix (d). The sensitivity values listed represent the equivalent sensitivity of the various tests in revealing the presence of residual oil globules. Examination of the data shows the atomizer test to be the most sensitive, and the fluorescent-dye test about five times less sensitive. About ten times less sensitive again are the spray-pattern, KFC, and copper-dip tests. The value obtained for sensitivity is dependent upon surface roughness, type of oil used, and orientation of oil molecules upon the surface. Further data on this subject will appear in a later paper. (See Appendix (d) for further interpretation of results.)

(c) *Conclusions*

A number of degreasing-evaluation tests have been studied, along with the newly developed atomizer test. Panels which had been soiled and then alkaline cleaned to various degrees were employed. The degree of cleaning was such that all panels had various amounts of residual oil present. The cleaning index for all the tests was determined. On the basis of these values, an equivalent sensitivity was determined for each test. The atomizer test was found to be the most sensitive by far, followed by the fluorescent-dye test, and the spray-pattern, potassium ferricyanide paper, and copper sulfate-dip tests were found considerably less sensitive, in that order. This order of sensitivity applies when a matte steel surface is used, when the soils used are lard and mineral oils, and when the residual oil is present mainly in the form of discreet globules or patches, the over-all concentration of which on the panel is in the range of 38×10^{-6}–805×10^{-6} g/cm². It is quite conceivable that, under different circumstances, the order might be different.

(*To be continued*)

This is contribution No. 24 from the Chemical Engineering Department, Engineering Center, Columbia University, New York, N. Y.

This paper is based on laboratory work done between September, 1950 and January, 1951.

THIRD INDUSTRIAL FINISHING EXPOSITION

to be Biggest 1952 Show at Chicago to Feature "Working Exhibits"

The International Amphitheatre, located in the heart of Chicago's bustling and sprawling industrial area, has been selected as the site of the INDUSTRIAL FINISHING EXPOSITION OF 1952. The dates are June 16 to June 20, inclusive.

Staged under the sponsorship of the AMERICAN ELECTROPLATERS' SOCIETY, and conducted simultaneously with the Society's 39th Annual Convention, the Exposition will offer more than 90,000 square feet of exhibit space, all under one roof.

Initial plans call for a generous expanse of "working" exhibits to be housed in the Amphitheatre's center Arena and adjacent North Wing. Exhibitors are being encouraged to show metal-finishing operations in action, as well as less mobile displays of plating and polishing equipment, metals, organic finishes, cleaners, material-handling devices, safety and sanitation materials, etc. Such exhibits will be supplemented by demonstrations "spotlighting" the Research Program of the Society.

Scene of such successful "big" shows as the Materials Handling Exposition, the Graphic Arts Exposition, and the National Metal Exposition, the Amphitheatre is noted for its adaptability to heavy-equipment installations and material movements. Particular consideration was given to the International Amphitheatre in selecting the Exposition site.

According to Exposition and Convention Chairman, Clyde Kelly, B. Mercil & Sons, Chicago, "the Industrial Finishing Exposition of 1952 will be an exhibitors' Show! Every promotional effort and every bit of careful planning is being used to insure the largest attendance of metal-finishing executives, purchasers, and those that influence the buying-habit pattern of the nation's industrial economy."

Sparked by the slogan, "It's Chicago for You in '52!", fifteen hundred preliminary announcements have been sent to presidents, sales managers and advertising managers whose firms have been listed as prospective exhibitors. In addition to announcing the dates of the Exposition and the amount of floor space available, the first broadside listed the average cost of space at approximately $2.25–2.50 per square foot. The announcement also emphasized the following facts: The Amphitheatre maintains privately owned and lighted free parking space for 4,000 automobiles. Free bus transportation will be maintained by the American Electroplaters' Society for registrants at the Convention to be held concurrently at the Stevens Hotel. Buses will shuttle between the hotel and the Exposition. Educational sessions scheduled for the Convention will be conducted at the historically famous Stockyard Inn adjoining the International Amphitheatre.

Eating and recreational facilities at the Amphitheatre are excellent. Exhibitors and visitors alike will be looking forward to the exclusive "branded" steaks served at the widely publicized Sirloin Room of the Stockyard Inn. Comiskey Park, home of the revitalized Chicago White Sox baseball team, is but a few minutes away, and offers a timely schedule of night baseball to be played under lights.

Complete Exposition details will be released around the first of January. Floor plans, contracts for exhibit space, names of Official Contractors, together with a description of their services and a listing of their prices will be contained in a brochure to be issued at that time. Exposition headquarters have been established at 35 E. Wacker Drive, Pure Oil Building, Chicago 1, Illinois.

International Amphitheatre, located at 43rd and Halsted Streets in Chicago, is easily accessible by fast, modern transportation. Surface cars, buses and elevated railway lines supplement a network of through streets and boulevards carrying visitors into the Loop and to all parts of the country's greatest Convention city

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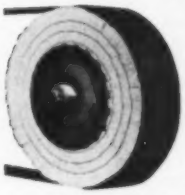

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Book Review

DR. HAROLD J. READ

Associate Professor of Metallurgy, Pennsylvania State College

GALVANIZING (Hot-Dip) by Heinz Bablik, 3rd edition, 1950, xiv + 502 pages. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Price, $10.00.

There is no other book on hot-dip galvanizing which even approaches Bablik's treatise for comprehensive coverage and sound scientific approach to the subject. He has thoroughly culled the literature and his own great experience for significant material, and has organized his findings into integrated and critical discussions of every phase of galvanizing theory and practice. The author's rather unusual twin role of lecturer at the Technical University of Vienna and manager of a galvanizing plant that has long been in his family has provided a background which enables him to present the idealities of theory without losing sight of the practical problems of production. And by the same token his descriptions of manufacturing operations reflect his knowledge of the fundamental processes and relationships which are involved therein.

The nature of scale on ferrous materials as well as the theory and practice for its removal by pickling are discussed in the first three chapters. An extraordinarily fine treatment of fluxes and their action comes next as a prelude to a long section on galvanizing theory. The theoretical treatment covers the formation of alloy layers, structures of the coatings, the effects of other elements in both the zinc bath and the ferrous basis metal, and corrosion phenomena as related to galvanized coatings. The long concluding chapter on practice covers every phase of plant operation from the selection of raw materials to the testing of products. All of this is illustrated with a profusion of tables, graphs, line drawings and photographs. In the latter category, attention should be directed to the large number of excellent photomicrographs which are found in the section on theory.

The lack of subject and author indexes is a serious deficiency, and the author's claim in the preface that the extensive table of contents is a more efficient substitute is not borne out by the reviewer's experience in trying to use it to locate specific subject matter. The reader will also be disturbed by references to the work of other investigators by name only in some parts of the book, although elsewhere full literature citations are given.

The translation is only fairly good, and there are passages, e. g., page 499, where one wishes that one were reading the original German, for if one must deal with German idioms, they certainly sound much better in their original form than in a *literal* translation. In spite of this, however, the book is not difficult to read.

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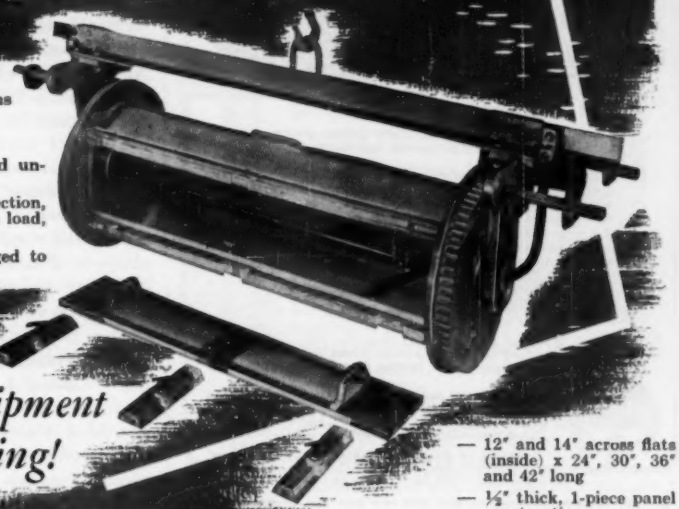

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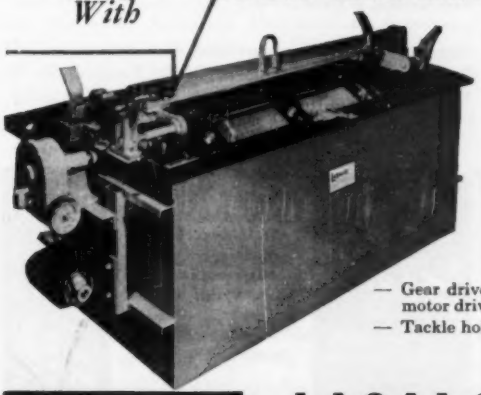

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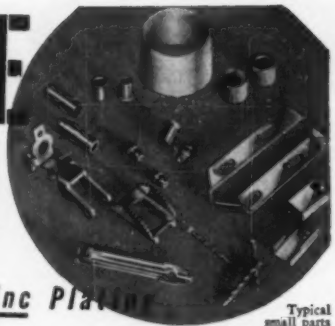

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Article Abstracts

No copies of articles are available at the offices of "Plating". Photostats may be had from libraries having files of the journal in question and offering photostat service, usually at 30-50 cents a page. Ask your public library to consult the Union List for names of libraries having the particular journal. Abbreviations used are those of Chemical Abstracts.

Activation of Metal Surfaces Preparatory to Electroplating. N. B. Balashova, Yu. S. Tsareva and A. T. Vagramyan. Doklady Akademii Nauk SSSR **71**, No. 1, 73–75 (1950); Henry Brutcher, Altadena, Calif., Tech. Trans. No. 2540.

Study of whether surfaces to be electroplated are active or passive, by a procedure originally developed for determining the rate of passivation during the electrodeposition of metals, including experimental procedure and results. Activation in cyanide-containing solutions of surface to be plated studied on the basis of copper and silver electrodes. Effect of potassium cyanide vs. ethyl alcohol.

Anodic Polishing of Non-Ferrous Metals. K. Huber. Chimia **4**, 54–62 (1950); Brit. Abs. **BI**, 931 November, 1950).

A brief historical introduction includes a survey of the electrical conditions under which the anodic polishing of metals occurs. The properties of metallic surfaces are defined by means of photographic examples of zinc, cadmium, copper, magnesium, and aluminum. A picture of the mechanism involved is derived from a discussion of the current-voltage curve: electrolytic polishing always depending on anodic passivity, even if incomplete, which is conditioned by the occurrence of a covering layer on the metal surface. The polishing of zinc in aqueous sodium hydroxide is described in detail.

Annealing of Titanium and Zirconium. A. M. Bounds and H. W. Cooper. Metal Progress **59**, 69, 100, 102 (January, 1951).

Discusses procedures and concludes that annealing

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in air or a noninert atmosphere produces scaling and surface hardness that cannot be eliminated by descaling or pickling. Inert atmospheres give satisfactory protection but are quite expensive, especially for large parts, wire, or tubing. Recommends vacuum annealing for light parts, and molten-caustic descaling.

Role of Ion Hydration in Electropolishing Baths. Eugene Darmois, Israel Epelboin, and Djafar Amine. Compt. rend. **231**, 1222–1223 (November 27, 1950).

The role of water supplied by solutions containing anhydride ions was studied. Results show that the effect is proportional to the quantity of free water, which depends directly on the degree of cation hydration. This property may be used in determination of the degree of hydration of ions.

X-Ray Diffraction Study of the Oxidation Characteristics of Nickel Pickled Sheet Iron as Related to Enamel Adherence. G. S. Douglas and J. M. Zander. J. Am. Ceram. Soc. **34**, 52–59 (February, 1951).

Systematic study was made of effect of nickel pickling on oxidation of bare enameling iron and of reactions taking place under ground-coat enamels. Results are charted, tabulated, and analyzed. 22 ref.

Aluminum Cylinders without Cast Iron Liners. P. M. Heldt. Automotive Ind. **104**, 32–33, 98, 100, 104 (February 15, 1951).

Describes recent developments in Germany which demonstrate feasibility of chromium plating of aluminum cylinder bores.

Electrodeposition of Germanium. Gustav Szekely. Sylvania Technologist **4**, 20 (January, 1951).

Describes two plating baths and results obtained.

Colouring Copper and Copper Alloys. I. Chemical Methods—Sulphide Finishes. II. Chemical Methods—Oxide Finishes. C. Harris. Metal Ind. (London) **78**, 23–25 (January 12, 1951); 43–44, 48 (January 19, 1951).

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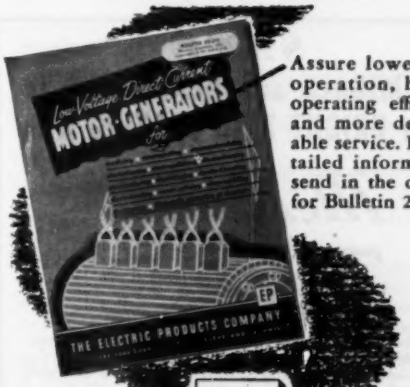

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coloring copper and copper alloys, the author has selected for description some of those giving consistent results.

Surface Treatment and Finishing of Light Metals, Part 5. S. Wernick and R. Pinner. Sheet Metal Inds. **28**, 79–87 (January, 1951).

Covers following aspects of the anodizing process for Al: theory; types of anodizing processes; application of anodizing; protective applications; decorative applications; adhesion of organic finishes; composition of the coating; dielectric or barrier layer; porosity; mechanism of film growth; and secondary reactions. 33 ref.

Scale Removal Technique with the Stainless Steels. Anon. Steel Processing **36**, 623–628 (December, 1950); **37**, 28–30 (January, 1951).

Part I describes mechanical and chemical methods and equipment. Eleven pickling-solution recipes are given and their applicabilities discussed. Data are charted. Part II gives details of experimental work on a ferric sulfate-hydrofluoric acid bath, and describes method for its control analysis.

The Structure of Metallic Electrodeposits; Cathodic Crystal Growth. G. I. Finch. Z. Elektrochem. **54**, 457–458 (October, 1950).

Discussion is illustrated by X-ray diffraction patterns.

Critical Review of Literature on the Toxicity of Industrial Wastes and Their Components to Fish. 1. Alkalies, Acids, and Inorganic Gases. Peter Doudoroff and Max Katz. Sewage and Industrial Wastes **22**, 1432–1458 (November, 1950).

126 references.

Hot-Spray Application of Lacquer. F. E. Piech. Official Digest 721–744 (October, 1950).

Presents extensive details of experimental work on the process developed by Commercial Solvents Corporation. Describes tests conducted with six different types of heaters. Data on effects of numerous variables are tabulated and charted. Coverage and cost comparisons show marked improvement. 22 ref.

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Patent Abstracts

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Copies of patents may be obtained by writing to Commissioner of Patents, Washington 25, D.C. Price 25 cents each.

No. 2,559,263, July 3, 1951—Electropolishing of Metals —H. B. Smith, assignor to R. Wallace & Sons Manufacturing Co., Wallingford, Conn.

The following is an example of the conditions which produced a highly brilliant polish or lustre on a silver plated soup spoon representing approximately 12 square inches of surface area immersed on a rack into a conventional silver plating solution at room temperature and of the following composition . . . to make one gallon of the solution:

	Ounces
Silver	5.1
Free potassium cyanide	8.2
Potassium carbonate	7.9

. . . a cathode 65 square inches in area was placed on either side of the anode at a distance of 4½ inches from it. No agitation whatsoever was employed during electropolishing. The composite varying potential was composed of a 17.5-volt direct-current-potential component and a 12-volt RMS (root-mean-square) meter-reading alternating-current-potential component and was applied intermittently. "On" times less than a second, preferably approximately 0.5 second, and "off" times of about 2 seconds were employed.

For polishing copper or brass, an electrolyte which is of the following composition may be employed:

	Ounces
Free sodium cyanide	15
Sodium carbonate	0.08
Water sufficient to make	1 gallon

The composite potential which is intermittently applied in polishing copper or brass is composed of a direct potential of about 11 to 15 volts and an alternating current potential of about 5.5 to 11 volts, it being understood that the a-c voltage is in any case not

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higher, but preferably lower, than the d-c voltage. The "on" and "off" times and current-density values are about the same as those which obtain in the polishing of silver. . . .

CLAIM 2. The method of polishing the silver plated surface of a metal member, comprising immersing said member in a cyanide electrolytic bath and subjecting said member in the bath to the electrolytic polishing action resulting from intermittent application of a positive potential of varying value to said member, as the anode, and to a companion cathode, said varying potential being composed of a direct-circuit potential in series with an alternating-current potential and applied for a plurality of time-spaced periods of about 0.5 second each with intervening periods of about 1.2 seconds each, the peak alternating-current potential being not greater than the direct-current potential.

6 claims, 2 figures.

References cited: U. S. Patents 1,777,121; 2,416,294; 2,473,923. German Patent 225,873. Iron Age 157, 65 (June 6, 1946).

No. 2,560,966, July 17, 1951—Method of Electroplating Copper Clad Stainless Steel Cooking Vessels—H. J. Lee, assignor to Revere Copper & Brass, Inc.

CLAIM 1. In a method of coating the substantially flat bottom and adjacent side-wall surfaces of revolution of a stainless-steel cooking vessel with a strongly adhering layer of electrodeposited copper, the steps of immersing said surfaces in a dilute sulfuric acid bath with said bottom surface in opposed-spaced substantially coaxial relation to the convex surface of revolution of an insoluble electrode of greater diameter than the diameter of the vessel and of material altitude, making said vessel a cathode and said electrode an anode while immersed in said bath for treating said surfaces of the vessel with electrolytically released hydrogen, and upon cessation of such treatment removing said vessel from said bath and substantially immediately immersing said surfaces thereof in a copper plating bath in opposed spaced relation to a soluble copper electrode and making the latter an anode and the vessel cathode.

CLAIM 2. . . . axially rotating the vessel while it is a cathode in both instances.

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CLAIM 3. . . . roughening the said surfaces of the vessel prior to treatment. . . .

5 claims, 8 figures.

References cited: U. S. Patents 2,142,512; 2,363,973. French Patent 805,918. German Patent 251,763. Leadbeater, Metal Ind. (London) **64**, 266–267 (April 28, 1944).

No. 2,561,222, July 17, 1951—Electrolytic Method of Stripping Nickel, Chromium, Copper, Zinc, Cadmium, Silver, Tin and Lead Electrodeposits from Ferrous Basis Metals and Compositions for Use Therein—Frank Passal, assignor to United Chromium Incorporated.

The bath is used at room temperature. Preferred anode current densities are ½–2 amperes per square inch.

CLAIM 1. A method of stripping nickel, chromium, silver, tin, lead, copper, zinc and cadmium electrodeposits from ferrous basis metal consisting essentially in immersing, as an anode, a ferrous basis metal having an electrodeposit of one or more of the aforesaid electrodeposits thereon in an aqueous bath consisting of 200 g/l (plus 100 per cent or minus 50 per cent) $NaNO_3$ and 100 g/l (plus 100 per cent or minus 50 per cent) CrO_3, and passing a direct current from said anode to a cathode.

3 claims.

References cited: Metal Cleaning Finishing **5**, 464–466 (November, 1933). Plating **35**, 404 (April, 1948).

No. 2,563,229, August 7, 1951—Method of Producing Bright Electroplate on Electropolished Surfaces—C. L. Faust and J. G. Beach, assignors by mesne assignments to Battelle Development Corporation.

Brass, nickel-silver, aluminum, copper, beryllium-copper and steel strips were electropolished and rinsed to remove the electropolishing bath solution. The strips were then immersed for 5 minutes at 100° to 170° F in a 10 per cent sulfuric acid solution (by volume of 1.84 specific gravity acid) containing 0.5 to 10 oz/gal of oxalic acid. The strips were finally rinsed and bright-nickel plated.

CLAIM. The method of producing an adherent bright

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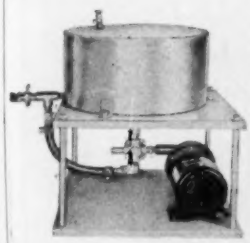

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nickel on an electropolished brass surface which comprises rinsing aforesaid brass surface, immersing the rinsed brass surface in a 10 per cent sulfuric acid solution containing 0.5 to 10.0 ounces per gallon of oxalic acid, rinsing the brass surface again, and finally plating said brass surface with a bright-nickel plate.

1 claim, 8 examples.

References cited: U. S. Patents 1,334,092; 1,954,745; 2,176,389; 2,383,434; 2,401,738; 2,430,435.

No. 2,563,903, August 14, 1951—Electrolytic Cell for the Deposition of Gold and/or Silver from Solutions—J. B. Zadra, assignor to United States of America as represented by the Secretary of the Interior.

CLAIM. An electrolytic cell adapted to strip gold from sulfide solutions thereof which comprises a cathode assembly having a vertical metallic pipe adapted to deliver gold-bearing solution to the cell and to serve as a negative bus bar for delivering electric current to said cell, said pipe being axially positioned in said cell and being provided near its lower end with an aperture for permitting egress of solution from said pipe into said cell, a radially extending metallic plate fastened to said pipe at its lower end, a plurality of upwardly extending wire rods spaced about said pipe and fastened at their lower ends to said plate for distributing electric current about said pipe, a nonconductive perforated basket enclosing the pipe, plate and rods to restrain solids while permitting fluid flow, said basket being adapted to contain charred-excelsior cathode material in contact with said rods; a perforated anode surrounding said cathode assembly adapted to permit flow of solution through said anode perforations, a weir cup surrounding said anode and said cathode assembly for controlling solution-level overflowing said cup, and a launder adapted to collect overflow of stripped solution from said weir cup.

1 claim, 1 figure.

References cited: U. S. Patents 591,571; 584,242; 1,019,969; 1,765,320.

No. 2,564,823, August 21, 1951—Electropolish Interrupler—E. H. Wallace, assignor to Oneida Limited.

CLAIM 4. An electric circuit for controlling a power source for supplying to the electrodes of an electrolytic cell a potential varying with the load, said circuit comprising a coil-actuated reversing relay movable between two positions for connecting the power source to the cell electrodes with either polarity, a voltage-reducing element connected in series with the cell electrodes in one position of the relay, a voltage-sensitive device having a circuit-making element rendered conducting in response to a voltage change connected across the electrodes so that the voltage difference due to polarization is impressed upon the device, the circuit-making element of said device being connected in series with the actuating coil of the reversing relay to operate the reversing relay thereby to apply a lower voltage of opposite polarity to the cell electrodes when the electrode-potential difference reaches a preselected

SCINTILLA MAGNETO DIVISION OF BENDIX AVIATION CORPORATION USES UDYLITE EQUIPMENT AND PROCESSES TO SAFEGUARD VITAL AIRCRAFT IGNITION PARTS

Udylite plating installation at Scintilla Magneto Division of Bendix Aviation Corporation showing ignition connectors of the Lockheed F-90 Fighter being processed.

Spark of life to military aircraft—both jet and propeller driven—is the electrical system. Failure can be fatal, so the Scintilla Magneto Division gives the metal of ignition connectors a protective coating against rust and corrosion with Udylite plating equipment and processes.

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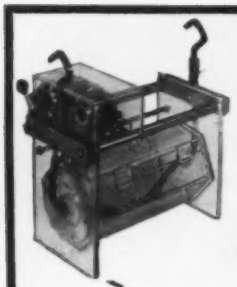

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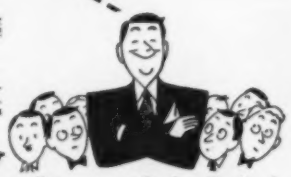

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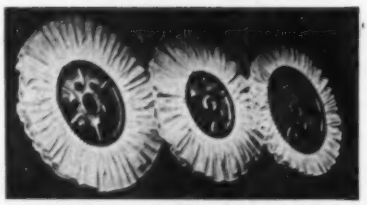

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Patent Abstracts

value, and a timing device having a switch interposed in the series circuit of the circuit-making element and the coil to operate the reversing relay to restore the original polarity after the elapse of a time interval from the impressing of the selected polarity sufficient substantially to depolarize the cell.

4 claims, 2 figures.

References cited: U. S. Patents 1,428,049; 1,534,709; 2,470,741. German Patent 603,910.

No. 2,569,368, September 25, 1951—Joining Metal Parts—D. B. Bradner, W. B. Stoddard, Jr., and P. S. Blickensderfer, assignors to The Champion Paper & Fibre Company, Hamilton, Ohio.

CLAIM 7. Electrolytic method of welding together edges of electrolytically formed sheet nickel which comprises: bending the sheets slightly at a distance from the edges to be welded so that said edges are completely displaced from the plane of the sheets; cementing the sheets, under pressure sufficient to flatten the sheets onto a support, from said edges to a point beyond said bends, onto a more rigid member, with an interposed reticular member; filling the space between said edges with an electrical conductor lying completely outside of the plane of the sheets to form, together with the bent down surfaces of the sheets, a trough for reception of weld metal, said trough having a width much greater than its depth, gently sloping sides and a smooth, uninterrupted, electrically conducting surface throughout its extent; treating the surface anodically in a concentrated solution of sulfuric and phosphoric acids; then electrolytically depositing nickel in said trough from a solution under conditions substantially the same as those used in electroforming the sheets being welded.

17 claims, 6 figures.

References cited: U. S. Patents 704,400; 901,115; 1,555,840; 1,674,941; 1,710,258; 1,790,738; 1,906,376; 1,956,233; 2,324,335; 2,333,567; 2,334,699; 2,371,823. British Patent 6,061. Italian Patent 258,694. French Patent 359,386. Swedish Patent 61,411.

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2— 100 A. G. E. 28 V.
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1— 800 A. G. E. 28 V.
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A. E. S. News

Special Meeting of the Supreme Society

President C. F. Nixon has issued to the Delegates, under date of December 1, 1951, a call for a Special Meeting on February 9, 1952, at the Benjamin Franklin Hotel, Philadelphia, Pa.

The object of the meeting is to provide a two-purpose forum, for the Executive Board to inform the Delegates of important developments and to discuss plans and objectives of the Society, and for the Delegates to present their views and to make helpful suggestions.

Change at the Helm

On December 1, Dr. D. Gardner Foulke took over the Executive Secretaryship from Dr. A. Kenneth Graham, who resigned last Spring but continued until his successor had familiarized himself with the manifold details of the Society's operations.

Dr. Foulke brings to the Society an intimate knowledge of the plating field, managerial experience, amicable relations with many of the Society's members, and an intense desire to see it grow and prosper—a combination that bodes well for the future.

Dr. Graham can look back upon a job well done during a period when the Society suffered from growing pains, not always easy to relieve. During his management the Society has gained in numbers, in resources, in influence, and in stature and prestige. His constructive initiative, steadying hand and devoted labors will long be remembered.

✣ Arthur W. Hothersall ✣

One of Great Britain's leading figures in the field of electroplating, Arthur Wesley Hothersall, passed away on October 20, age 56.

Hothersall was best known as the leader of the research team on electrodeposition at Woolwich Arsenal, which has made many outstanding contributions to the knowledge of electroplating. He was the author of many papers of high quality.

A founder and past president (1937–1939) of the Electrodepositors' Technical Society, he received its Gold Medal, the second one presented, at the Society's Silver Jubilee this year.

Hothersall visited the United States several times. His many friends here join with their British colleagues in sharing the loss and sorrow at the passing of a great and good man.

Canadian Research Project

The A. E. S. Research Project No. 14, "Methods for Removal of Impurities from Commercial Electroplating Solutions", was activated on October 1.

This project is placed at the Ontario Research Foundation, Toronto, and the agreement entered into with the Foundation is conditioned upon the Province of Ontario contributing one-half the cost as recommended by the Research Council of Ontario.

Dr. A. E. R. Westman, Director of the Department of Chemistry, has been designated Project Director, and the Project Associate is Dr. T. L. Batke, Research Fellow. The Project Committee consists of W. M. Tucker, Eastman Kodak Company, Rochester, N. Y., Chairman; W. G. Finlay, The M. & Y. Products Company, Hamilton, Ont.; Charles Hubbleday, Canada Cycle & Motor Co., Weston, Ont.; and Leonard Wray, Bomac Electrotype Co., Ltd., Toronto, Ont.

The activation of this project is the culmination of much effort sparked by Kergan Wells, C. D. Short and John Acheson of the Toronto Branch. The following sustaining members in Canada have made the project possible:

Armalite Company, Ltd., Toronto
Bendix-Eclipse of Canada, Ltd., Windsor, Ontario
Canada Skate Manufacturing Company, Ltd., Kitchener, Ontario
Canadian General Electric Company, Ltd., Peterborough, Ontario
Canadian Hanson & Van Winkle Company, Ltd., Toronto
Canadian Motor Lamp Company, Ltd., Windsor, Ontario
John Galloway Company, Kitchener, Ontario
John Inglis Company, Ltd., Toronto
International Nickel Company of Canada, Ltd., Toronto
Lea Manufacturing Company of Canada, Ltd., Toronto
Standard Sanitary & Dominion Radiator Ltd., Toronto

Sustaining Members

In addition to those in Canada listed above, others have joined the Society as sustaining members:

Jack Beall, Pasadena, Calif.
Midwest Chrome Process Company, Detroit, Mich.

Their support of the Society's research activities is greatly appreciated.

In Guy Cole's Memory

The Research Committee, at its meeting on September 1 in Pittsburgh, Pa., passed the following

RESOLUTION

WHEREAS our Chairman, Guy M. Cole, passed away on August 10, 1951, and

WHEREAS he had faithfully served the Research Committee as a member and as Chairman of the Research Directing Subcommittee, and

WHEREAS he had, as the prospective Chairman of the Research Committee, after consultation with numerous persons, devised programs and procedures for effectively conducting the work of the Committee under existing conditions, therefore

BE IT RESOLVED that the Research Committee hereby expresses its great sense of loss at the passing of Guy M. Cole, and its deep appreciation of the devoted service that he has rendered to the Research Committee, The American Electroplaters' Society, and the electroplating industry, and

BE IT FURTHER RESOLVED, that a copy of this resolution be sent to the family of Guy M. Cole, and that it be published in PLATING.

Grand Rapids Branch Supports the Research Program

The following letter has been received from the Secretary of the Grand Rapids Branch, Mr. Keith E. Yhouse:

"At the National Convention in Buffalo this year, the Grand Rapids Branch was awarded a prize of $50 for its increase in membership over the past year.

"Appreciating the need of additional funds for the Research Projects and the immense benefits gained from them, our members wish to donate this money for that use. Enclosed is a check for $50."

✣ Theodore C. Eichstaedt ✣

Theodore C. Eichstaedt, an old-timer in the plating industry, passed away on August 28, at the advanced age of 80 years, in Lynn, Mass.

In his day, Eichstaedt was one of the outstanding platers in Detroit and lived there until he retired a number of years ago, first to Florida and then to Lynn, Mass. He was one of the first members of the American Electroplaters' Society and was very active in its Detroit Branch, which made him an honorary member in 1946. He contributed several papers on nickel plating, and was a constant visitor at, and at times a Branch Delegate to, the A. E. S. Conventions.

Eichstaedt is survived by a sister, Anna M. (Mrs. H. S.) Bissell of Ormond Beach, Fla.

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Branch News

COMING EVENTS

NEWARK BRANCH

ANNUAL EDUCATIONAL SESSION AND CHRISTMAS PARTY
Robert Treat Hotel
Educational Session
Friday, December 14, at 8 P. M.

HAROLD FAINT, Industrial Filter & Pump Manufacturing Company, "Filtration"
F. L. LAQUE, The International Nickel Company, "Galvanic Corrosion"
DR. W. R. MEYER, Enthone, Inc., "Bright Dipping and Pickling of Metals"

Christmas Party and Banquet
Saturday, December 15, at 7:00 P. M.
GEORGE WAGNER, *Chairman*

ALLENTOWN-READING BRANCH

On September 19, 26 members and guests were present at the dinner meeting at Spurgeon's Hotel, Allentown, Pa.

The evening was devoted to Buffalo Convention Highlights. In his talk on "Recent Developments in Electroplating", DR. SAMUEL HEIMAN, Chief Chemist of the Philadelphia Rust Proof Company, summarized and commented on the technical papers given at the Convention. He also touched briefly on PR plating; on leveling as demonstrated in the Perflow, nickel-cobalt and PR processes; and on applications of ion exchange and radioactive metals to plating.

DELEGATES DR. EARL SERFASS, NORMAN MILLER and MAL MERKLE, and one of the guests, MR. JOSEPH KUSHNER, reported on the lively discussion held on the subject of increasing the per capita tax, on the election of officers, and on the convention cities: Chicago, Philadelphia, and New York. Naturally the members were pleased to hear that the Branch won a cash prize in the 1950–1951 membership competition.

Two applicants and one on-transfer from Philadelphia were admitted to active membership. The committee headed by Louis Peterson reminded the members of the Annual Informal Dinner-Dance to be held on October 20. PRESIDENT CARL SWARTZ appointed HOWARD SCHEARER and LARRY MCMICHAEL to a By-Laws Committee, with JAMES RIEGEL as chairman. RAYMOND HOUSEL, JOHN ULRICH and NORMAN MILLER were appointed as additional members of the Membership and Attendance Committee to serve under MAL MERKLE.

PEARL T. TREISBACH,
Secretary-Treasurer

BALTIMORE-WASHINGTON BRANCH

At the first Fall meeting, at the Park Plaza Hotel in Baltimore on October 9, MR. H. J. STRUCKHOFF, President of Lasalco, Inc., St. Louis, discussed one of his pet topics, "What Happens in a Plating Barrel". In addition to his excellent presentation, he also displayed color films of mock-up barrels in operation, which fortified all his theories.

At the short business meeting a motion was passed to present Dr. W. Blum with a practical gift at the November meeting, just prior to his retirement.

A twenty-minute color film was then shown by Mr. Struckhoff—Grand Canyon as few have seen it, clear, well-defined and without fog or mist.

The members then retreated to the rear of the room for refreshments and tete-a-tetes.

J. J. HUGHES, JR., *Secretary*

BRIDGEPORT BRANCH

Forty-four members and guests were present on September 14, when WILLIAM THOMPSON, a member of the Board of Managers was elected to Branch Honorary Membership. It was decided to present him and the other honorary members—WILLIAM FLAHERTY, GEORGE J. KARL, BEN F. KUSTERER, and GEORGE MORROW—with suitable framed certificates.

The following procedure for election of officers was agreed upon: nominations by the members during March; election in April; installation in May.

Two members were suspended for nonpayment of dues, and one new member was received by transfer.

Introduced by LIBRARIAN PHIL BAILIN, MR. AL SQUITERO discussed "Scarce Materials", especially Government restrictions on their use and the need for substitutes. Substitutes for nickel include chromated bright zinc; silver; a white zinc-copper alloy, for which the solution requires very careful attention; 0.0005-0.001-inch copper buffed to high lustre

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and chromium plated, for which chromium plating racks may have to be reconstructed for satisfactory coverage and procedures may have to be changed; copper-very thin nickel-chromium, which is better than copper-chromium according to salt-spray tests. Bright zinc has been used successfully as a substitute for cadmium; other substitutes include an alloy of 80 tin–20 zinc (approved for Government work) and copper, tin, or zinc (on electronic parts). Iron plated printing plates have been found very satisfactory as substitutes for nickel plated plates. Sulfuric acid anodizing was said to be better than chromic acid anodizing in many cases. Platers should reclaim all solutions and reuse them.

Refreshments were served through the courtesy of Mr. Floyd C. Tatum of Oakite Products, Inc., Hartford, Conn.

Joseph G. Sterling,
Secretary-Treasurer

BRIDGEPORT BRANCH

First Vice-President Ray Goral presided over the meeting on October 12, at which 42 members and guests were present.

Three applicants were elected to membership, and one resignation was accepted.

The group paid tribute to the memory of William Thompson, who had passed away. He was truly a good man, well liked by all. The passing of the wife of member Frank Salvaggio, sister-in-law of member Anthony Salvaggio, was announced. Floral offerings have been sent to both families.

Joseph G. Sterling, who had served as secretary-treasurer for 11 years, tendered his resignation on account of being transferred by the General Electric Company from Bridgeport to Louisville, Ky. The Branch will hold a dinner party in his honor on October 26. Gerald B. Rice was elected unanimously to fill out his term.

Librarian Phil Bailin (who will manage the Christmas Party) served as technical chairman and introduced the speaker, Mr. Kenneth Bellinger, of the Chemical Corporation, Springfield, Mass. Discussing "Conversion Coatings on Zinc and Cadmium", he recommended the following cycles: *For steel*—(1) anodic cleaner, 10–12 oz/gal, (2) cold rinse, (3) 50 per cent by vol muriatic acid dip, (4) cold rinse, (5) anodic treatment in a cold solution of 8 oz/gal sodium cyanide and 4 oz/gal caustic soda, (6) cold rinse, (7) zinc plate. *For zinc-base diecastings*—(1) anodic cleaner, (2) cold rinse, (3) 5 per cent by vol formic acid dip for 35 seconds, (4) rinse, (5) zinc plate. The preferred *zinc plating solution* contains 4.5 oz/gal zinc, 13.5 oz/gal sodium cyanide, 12 oz/gal caustic soda, with a NaCN/Zn ratio of 3, at 85–95° F. Copper contamination may be removed by low-current-density dummying or by treatment with 3 lb/100 gal of zinc dust. *Bright dipping* is done according to the following procedure after zinc plating: (1) rinse until all alkali has been removed, then rinse again, (2) bright dip for 10–25 sec at 85–90° F, (3) rinse, (4) leach in a 2–4 per cent alkaline solution, (5) hot rinse and dry, (6) lacquer with suitably selected clear lacquer.

For *zinc plating of gray-iron castings*, he suggested a solution containing 7.5 oz/gal zinc, 2½ oz/gal sodium cyanide, and 18 oz/gal caustic soda, with a strike preceding its use.

Refreshments were served through the courtesy of Ray W. Goral of Enthone, Inc.

Joseph G. Sterling, *Secretary-Treasurer*

CHICAGO BRANCH

On September 14, the Branch started its new season of educational sessions, and in order to bring out a maximum number of members, a panel on "Mechanical Plating" and refreshments were the lures. William Geismann of National Lock, Dr. Harold Wiesner of Bendix, and Marion Longfield of Pheoll were the panel members. All the speakers were excellent, and we particularly want to praise the National Lock Company for permitting Bill Geismann to present a vast amount of statistical data correlated into a quality control plan for barrel plating. This sort of management cooperation cannot be too highly commended. The meeting was further embellished by a short talk by our own H. A. Gilbertson, newly elected honorary member of the A. E. S.

J. M. Andrus, *Librarian*

CHICAGO BRANCH

On October 12, the Chicago platers were introduced to a new development in alloy plating. The nickel-tin-alloy plate, a product of years of research by the Tin Institute of England, was indeed impres-

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sive. It is said to possess constant composition regardless of depth of recess (the bath having excellent throwing power despite its acid nature) and corrosion resistance superior to that of chromium. The color is between that of silver and nickel, with an attractive rose tint. Dr. J. W. Cuthbertson of London, England, Assistant Director of Research of the Tin Research Institute, made an excellent presentation. The general comment was, "The best paper of the year".

J. M. Andrus, *Librarian*

CINCINNATI BRANCH

Despite the counter attraction of hockey and prize fights, the members turned out in large numbers on October 24, and were well rewarded for their efforts. Some 37 platers, buffers, etc., enjoyed the usual fine dinner and comradeship, and were joined by additional members for the meeting.

The applications of three men, including two students, were accepted unanimously.

Mr. J. D. Patrick, Westinghouse Electric Corporation, Pittsburgh, was the speaker. In addition to his chosen subject, "Copper Plating by the PR Process", Mr. Patrick dwelt on substitute finishes, pointing out fourteen different useful substitutes: copper, nickel, lacquer, albaloy, white brass, bright zinc and clear chromate dip in various combinations.

In discussing PR plating, Mr. Patrick stated that a plain steel tank could be used, although a rubber lining was preferred (plastic linings would not stand up due to high temperatures). He recommended the use of diaphragms to prevent roughness, stressed that agitation was essential, and cautioned that continuous filtration would give the better results. The use of treated water is a must. Using slides to good advantage, Mr. Patrick concluded by comparing sodium solutions and potassium baths.

The evening was most successfully concluded with a Social Hour sponsored by Hanson-Van Winkle-Munning Company.

Charles Wise, *Secretary*

DALLAS-FORT WORTH BRANCH

The Branch held its September meeting at the Hotel Adolphus on the 17th, with 31 members and guests present.

There were two guest speakers: Mr. Harold W. Faint, Sales Manager of Industrial Filter & Pump Manufacturing Company, Chicago, Ill., who gave a talk on filtration and pumping; and Mr. Fred Green, of Crown Rheostat & Supply Company, Chicago, Ill., who dealt with barrel tumbling. Both talks were very interesting and were followed by considerable discussion of problems that the speakers brought to mind.

C. A. White,
Secretary-Treasurer

DETROIT BRANCH

The monthly meeting on October 5 had an attendance of some 200 members.

Mr. Allen E. Chester of the Promat Division, Poor & Company, Chicago, was the featured speaker, and his talk on "white-brass" plating was most informative and of great interest to his audience, faced with rapidly dwindling allotments of nickel.

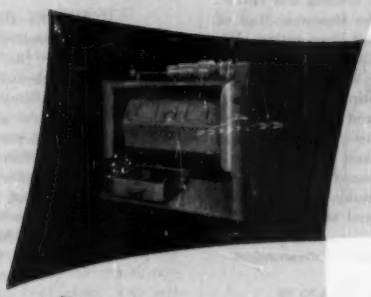
Another highlight of this meeting was the attendance of A. W. Wallbank, of the Guest Keen & Nettlefold group of British companies and immediate Past President of the Electrodepositors' Technical Society of Great Britain. As guest speaker, he presented a most interesting discussion of British plating techniques as contrasted to those of the U. S.

Walter Pinner reported progress in his committee's chore of handling publicity and favors for the Christmas Party, and H. Tideman reported a demand for tickets exceeding the 1,600 limitation imposed. This annual event attracts more and more out-of-town members of the Society.

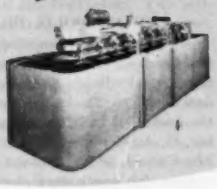
E. A. Steegar,
Publicity Chairman

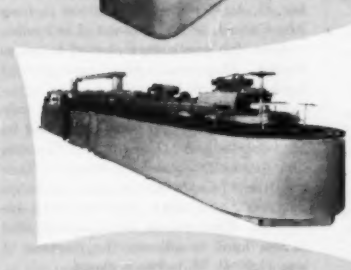
HAMILTON BRANCH

The initial meeting of the 1951-1952 season was held on September 20 in the conference room of the West End Plant of the Canadian Westinghouse Company.

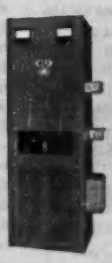


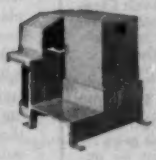
CROWN equipment

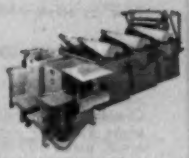




- Automatic Machines for Plating-Anodizing, etc.
- Dryers, Centrifugal
- Partially Automatic Plating Machines
- Plating Barrels
- Rectifiers
- Rheostats, Switches — Controls
- Tray — Transfer Type Cleaning — Rinsing — Dipping Units
- Tumbling Barrels — "Horizontal" — "Tilting"
- Special equipment designed and built







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INDICATE A 1171.

FOR SALE

1—USED 1000-ampere 6-volt or 500-ampere 12-volt **l'Hommedieu,** self-excited Generator, direct connected to a new 10 HP 60-cycle, 3-phase **Westinghouse** induction motor, speed 1150 RPM, with control board 220/440 volt. . **$900.00**
Price on above—NEW, approximately **$2,000.00**

1—USED 1500-ampere 6-volt or 750-ampere 12-volt **Electric Products,** separately excited Generator, direct connected to a used 15 HP 60-cycle, 3-phase 220/440 volt **Westinghouse** induction motor, speed 900 RPM, with control board. **$1,500.00**
Price on above—NEW **$3,139.00**

1—USED latest style 1000-ampere 6-volt or 500-ampere 12-volt **Electric Products,** separately excited generator, direct connected to a used 10 HP 60-cycle, 3-phase 220/440 volt **Electric Products** Synchronous motor, speed 900 RPM, with control board. **$1,250.00**
Price on above—NEW **$2,509.00**

1—USED only a few months, 500-ampere 6-volt, separately excited **Chandeysson 25-degree Generator,** direct connected to a 5 HP 60-cycle, 3-phase, 220-volt, 25-degree Synchronous motor, speed 873 RPM, complete with control board; machine so new that generator brushes are not fully seated. **$1,000.00**
Price on above—NEW **$1,864.00**

1—**NEW latest style** 1000-ampere 6-volt or 500-ampere 12-volt **Electric Products,** separately excited Generator direct connected to a new **Electric Products** 10 HP 60-cycle, 3-phase, 220/440 volt Synchronous motor, speed 720 RPM, with control board (in original crate). **$2,000.00**
Price on above—NEW **$2,509.00**

1—**NEW latest style** 2500-ampere 6-volt or 1250-ampere 12-volt **Chandeysson** separately excited Generator, direct connected to a new **Chandeysson** 25 HP 60-cycle, 3-phase 220/440 volt Synchronous motor, speed 600 RPM, with control board. **$4,819.00**

All used machines in excellent condition, full commutators and the price for comparable machines cannot be obtained elsewhere.

The new 2500-ampere **Chandeysson** machine is its standard price; however, can be delivered immediately and not 4 months or longer.

Prices all f.o.b. Chicago and subject to prior sale.

GEORGE A. STUTZ Mfg. Co.

1645 Carroll Avenue
Chicago 12, Illinois

Branch News

All meetings of the current season will be held there.

It was decided to end each fiscal year on February 28 instead of May 1.

The speaker of the evening was Dr. F. A. Lowenheim of the Research Staff of the Metal and Thermit Corporation. His subject was "Tin Electroplating". Dr. Lowenheim stressed the importance of tin in the electroplating field. He covered both alkaline and acid baths, and drew comparisons between the sodium stannate and potassium stannate baths. The talk was accompanied by slides, and proved very enlightening. A lively discussion period climaxed the very enjoyable evening.

J. Horden, *Correspondent*

HARTFORD BRANCH

The meeting on October 15 was attended by 70 members and guests. Preceding the meeting, a movie entitled "Channel Bass and Stripers" was shown, after which Mr. George B. Hogaboom gave a report on "Latest Developments in in the Finishing Industry".

The speaker of the evening was Mr. Webb Knight, of the Knight Plating Company, Detroit, Mich., whose subject was "Finishing of Bulk Work". With the help of a movie, Mr. Knight described the construction and operation of a machine in their plant which is capable of buffing 30,000 or more sheet-metal screw heads an hour in preparation for plating. By means of revolving hoppers, pick-up fingers, slots of various widths to accommodate different-diameter screws, etc., the screws are carried by chain conveyors to the buffing wheels traveling at 3,000 rpm, where the desired finish is obtained with the use of the proper buffing compound.

Due to the shortage of cadmium and nickel, much zinc plating is being done, and conversion coatings are used in the plant. Chromium is being plated directly over copper, and lacquered or waxed. White brass (0.0002-0.0003 inch thick) followed by chromium offers good salt-spray resistance; the bath has good throwing power, and the brass is easier to strip than nickel. The white-brass solution requires close analytical control.

The technical chairman for the evening was Eugene Dowling, and refreshments were served through the courtesy of Apothecaries Hall Company.

Stanley Platoe, *Secretary*

HOUSTON BRANCH

The Branch held its first meeting of the Fall season on September 20, at the Ming Palace Restaurant. Twenty-four members and guests were present.

Mr. Harold Faint, Industrial Filter & Pump Manufacturing Company, Chicago, spoke on "Filtration of Plating Solutions", and Mr. Fred Green, Crown Rheostat & Supply Company, Chicago, on "Barrel Tumbling and Finishing". The presentations by these two very fine speakers were greatly enjoyed by all.

J. R. Byerley,
Secretary-Treasurer

HOUSTON BRANCH

The Branch received its Permanent Charter on October 18.

The Charter presentation was made by A. E. S. Past President William J. Neill, who also gave a brief history of the Society and then presented a very interesting talk on "Electropolishing and Plating of Nonconductors".

The Houston Branch feels highly honored to receive its Charter, and wishes to thank the Society and Mr. Neill.

J. R. Byerley,
Secretary-Treasurer

INDIANAPOLIS BRANCH

The Branch held a monthly meeting on October 3 at Fox Steak House, with the usual steak dinner preceding the business meeting. Thirty-two were present at the dinner, 43 at the meeting. One member, C. A. Barker, again drove in from Mt. Carmel, Ill., a distance of 165 miles.

Four applicants were elected to membership. There was much discussion about the next annual dinner-dance.

A round table discussion on the subject of hard chromium was conducted by the following panel: C. Gough, A. Kriese, Dr. Ammerman and W. Niehaus. Various phases of hard chromium plating were discussed, and many questions were answered. There was so much interest that it was hard to adjourn the meeting; it was 11:00 P. M. before it closed.

Edw. Bruck, *Secretary*

JACKSON-LANSING BRANCH

The members of the Branch convened for their October 9 meeting at the Meadow Lark Inn, where an excellent chicken dinner family style was served. After Fred Stuckenberg, our stalwart secretary, had reached his limit of fried chicken, President W. H. Mogle called the meeting to order. The first order of business was a rising vote of thanks to Wagner Brothers for the excellent dinner.

A record number of members came out to welcome the new A. E. S. President, Cleveland F. Nixon, who spoke interestingly about the future plans of the Society. He stressed the importance of building a sound financial structure. A meeting of the Branch Delegates will be held to re-examine the need for increasing the dues.

Mr. R. J. Rominski, of Research Division, General Motors Corporation, presented a well illustrated and interesting talk on "Rinsing for Electroplating". This subject has a vital interest to many of the members where stream pollution is of grave concern.

At the close of the meeting, LARRY HENDERSON presented a movie showing the logging operations of the Chicago *Tribune* to supply its great need for wood pulp.

J. H. HOEFER,
Correspondent

LOS ANGELES BRANCH

Over 60 members and guests heard a paper presented by MR. SID SOLOMON, of the Los Angeles Water Softener Company, on October 10. Speaking about "Water Demineralization in Plating Rooms", he stressed that he was not discussing simple water softening, which removes scale-producing cations by replacement with sodium salts, but the complete removal of cations and anions by two-stage treatment with selected resins to produce virtually distilled water, or at any rate, water having 10 ppm or less of total dissolved solids. Two suitably activated resin beds are required. In the first cell, cations are removed by resins activated with hydrogen ions, i. e., treated with an acid usually sulfuric. After such ions as sodium, potassium, calcium, magnesium and iron have been removed, the acidic discharge goes to the second cell, the resin in which is regenerated with an alkaline material, such as caustic soda, and therefore is charged with hydroxyl ions for replacement of such anions as sulfate or chloride. Water of high purity will be discharged from this cell. The cost is predicated on the size of the equipment, which in turn is calculated from water volume and hardness. On the basis of 750-ppm raw water, which is prevalent here, the chemical cost of producing demineralized water will be of the order of 40–80 cents per thousand gallons. Regeneration will take some 2–4 hours, with perhaps 0.5–1 hour of labor required.

Demineralization can be applied, using a suitable resin, to chromic acid anodizing solutions for the removal of iron and alumina. At some future date, a single amphoteric resin, regenerated with steam, may be a possibility. This will mean single treatment. The resins are extremely long lived, phenolic resins disintegrating very slowly and polystyrene resins hardly at all. At present, demineralization is not economical for plating-room-waste disposal.

Inasmuch as the water that platers must deal with in this territory runs from 250 ppm for Owens Valley water, 450–500 ppm for Los Angeles River water, and 750–800 ppm for Colorado River water, the talk was timely and well received. A good deal of discussion followed.

G. S. KRENTEL, *Secretary*

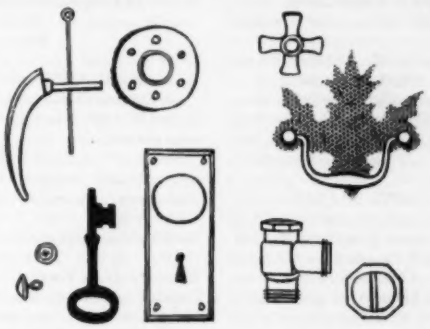
MILWAUKEE BRANCH

A regular meeting was held at the Red Arrow Club on October 5.

After PRESIDENT EVERETT ROBINSON had discussed plans for the 18th Annual

SAVE TIME AND DOLLARS!

BARREL FINISH YOUR METAL PARTS



Use the Correct Wyandotte Compound

More and more metal-finishing plants are realizing the advantages and economies of barrel finishing. And they find that when they use Wyandotte compounds, they obtain outstanding results.

Because in barrel finishing, the selection of the proper compound is just as important as choosing the correct type and size medium—or as controlling operating conditions.

The compound must suit both the work and the medium. It must take care of hard water conditions, keep media and barrels clean. And, of course, it must develop the desired finish on metal parts.

Wyandotte research and technical experience have developed barrel-finishing compounds which are widely accepted as offering superior performance at minimum cost.

Ask your Wyandotte representative to help you select one of the following products for your barrel-finishing jobs:

Wyandotte Burnek 22—for burnishing ferrous and non-ferrous metals.

Wyandotte Light Alloy No. 1—for deburring some ferrous and non-ferrous metals.

Wyandotte Burnishing Compounds 317 and 321—for deburring and burnishing some ferrous and non-ferrous metals.

Wyandotte Burnishing Powder—for deburring and burnishing ferrous metals.

THE WYANDOTTE LINE—products for burnishing and burring, vat, electro, steam gun, washing machine and emulsion cleaning, paint stripping, acid pickling, related surface treatments and spray-booth compounds. An all-purpose floor absorbent: Zorball. In fact, specialized products for every cleaning need.

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Wyandotte Chemicals Corporation
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Please send free copy of technical report giving information on barrel finishing.

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Walter Pinner Dinner, Mr. Hubert M. Goldman, of Enthone, Inc., discussed "Black Oxide Coatings", describing the several processes that are used to form oxide coatings of iron, steel, copper, zinc, cadmium, stainless steel and aluminum. A discussion of the composition of these solutions brought out that sulfide coatings on steel offer little or no corrosion protection.

Our thanks go to Mr. Goldman for an interesting and enlightening evening.

Delicacies that titillated the palate were served through the courtesy of Ardco, Inc.

E. F. Piellusch,
Secretary-Treasurer

NEW HAVEN BRANCH

At the first technical meeting of the season, on October 9, President Bernie Gaffney outlined the plans for the coming year, and Librarian L. Durney summarized the technical program which he has arranged, with January set aside for a social meeting.

Mr. Hans Schlaupitz of R. Wallace and Sons reviewed the paper by H. Parkinson, published by the British Tin Research Institute, on the new tin-nickel-alloy plate recently developed after several years of research. Containing 65 per cent of tin and 35 per cent of nickel, it is deposited bright and retains its lustre permanently.

The principal speaker was Mr. John J. Martin, of Enthone, Inc., who presented an interesting talk on the "Fundamentals of Rack Design". He covered all basic principles, which served as a refresher course for most members. The different types of rack coatings were discussed, and the advantages of each were pointed out.

Clark A. Brown, *Secretary*

NEW YORK BRANCH

The meeting on September 28 was devoted largely to a general discussion of shop problems. With Dr. J. W. Cuthbertson and Mr. A. W. Wallbank from England present in the meeting, much of the discussion revolved about the nickel-tin-alloy-plating process employed in Great Britain, with Mr. Wallbank answering many questions about plant procedures.

One new member was elected, and five applications were submitted.

It was announced that George Shore will be General Chairman of the A. E. S. New York Convention in 1954.

Peter L. Veit,
Recording Secretary

NEW YORK BRANCH

On October 12, four new members were elected and two membership applications were received.

President George F. Herrmann announced that Adolph Bregman had passed away. It was decided to set aside one page in the annual New York Branch Book to honor his memory.

After A. E. S. Executive Secretary Elect, Dr. D. G. Foulke, had been introduced, a preliminary discussion was held about Branch honorary membership.

Mr. Peter L. Veit gave a short talk about "Barrel Finishing", based on a series of articles by him currently published in Metal Finishing.

Peter L. Veit,
Recording Secretary

PHILADELPHIA BRANCH

The opening meeting of the Fall and Winter season was held at the Broadwood Hotel on September 28. The evening started with a fine dinner attended by 44 members and guests.

Branch President Alfred Pope opened the meeting following dinner, by introducing Dr. A. Kenneth Graham, retiring A. E. S. Executive Secretary; A. E. S. Second Vice-President Dr. G. P. Swift; Dr. D. Gardner Foulke, Executive Secretary Elect; Mr. G. Soderberg, Editor of Plating; and Mr. W. A. Raymond, Editor of *Metal Finishing*.

Albert Hirsch, long-time Branch member who had known the speaker since 1922, introduced Mr. George B. Hogaboom, who delivered the fourth George Gehling Memorial Lecture. Mr. Hogaboom divided his talk into two parts: (1) George Gehling and the "Platers" Society; and (2) Current Zinc Plating Problems—Conversion Coatings. The first part was devoted to reminiscences of his early associations with George Gehling, starting in 1909. He spoke of the founding of the Society and its early aim to educate the plater, and felt that the education of the plater should again be the foremost consideration. Production problems should again be stressed; the man at the tank is the one who requires the help.

In the second portion, Mr. Hogaboom stated that it was not always the conversion-coating solutions that were to be blamed for troubles encountered in their use. There were difficulties, not fully realized, in operating zinc solutions which contribute materially to the problem. Thus, differences in zinc deposit structure affects markedly the deposit weight, and the relation of zinc, cyanide and caustic soda in the solution has a bearing on the quality of the deposit. To illustrate more clearly some of the variables and their effects Mr. Hogaboom, with the aid of slides, showed that caustic soda improves the conductivity and clarity of the solution; that high caustic soda gives high cathode efficiency even at a low metal content; that low caustic soda gives a cathode efficiency varying with current densities. His slides also showed how temperature, carbonate content, and current density affect the operating characteristics of the solution; and that a high caustic soda content gives finer-grained deposits, high cyanide and chloride, coarser deposits.

The discussion brought out that the optimum ratio between caustic soda and zinc content varied somewhat at low metal content and was not known when the concentrations were high. The lead in 97 per cent zinc anodes enters the deposit and will produce streaky coatings following chromate immersion.

Dr. Samuel Heiman reported briefly on the Buffalo Convention. The Secretary reported on the suspensions for nonpayment of dues.

I. Wm. Marcovitch, *Secretary*

PITTSBURGH BRANCH

Twenty-five members were present at the dinner, and approximately 45 attended the business session on October 11. We were very pleased to have an exceptional number of guests, honoring the Branch and the speaker: J. F. Whitehead, Westinghouse Electric; Wm. H. Wooster, National Casket Co.; Irvin M. Weiss, United Chromium, Inc.; Bob Preston, Johns Manville; Al Pope, Penna. Salt Mfg. Co.; M. S. Patterson, American Chemical Paint Co.; Russ McCorkle, Collins & Wright; J. M. Lloyd, Flannery Mfg. Co.; Joseph Lupnacca, Spang-Chalfant; Bill Gordon, MacDermid-Western; William Fargo, L. D. Cochran, and Bill Hennessey, the latter one of our past presidents, recently transferred to Philadelphia.

From all indications, our December "Milwaukee Night" is going to be a 'bang-up' affair. The plans for our Annual Banquet are also well along the way.

Librarian Bob Varner introduced the speaker, Mr. W. A. Helbig, Chemical Engineer, Darco Dept., Atlas Powder Company, whose subject was "Purification of Electroplating Solutions by Filtration and Activated Carbon Treatment". A few of the topics which Mr. Helbig discussed were: (1) general principles of filter operation; (2) solids capacity of a filter; (3) effective filter area; (4) solids capacity *vs.* effective filter area; (5) recirculation and precoating; (6) measurement of filtration rate; (7) regulation of pressure and flow rate; (8) periodic and continuous treatment with activated carbon.

The lengthy question period which followed was concrete evidence of the interesting and informative nature of Mr. Helbig's discussion. The meeting was brought to a close by Rex Goldach.

R. H. Schindler, *Secretary*

ROCKFORD BRANCH

The October meeting of the Rockford Branch was held in the Hotel Faust on the 8th, with dinner served at 7:00 P. M. as usual. First Vice-President Vern Wissen opened the meeting.

Librarian Wm. Geissman introduced the speaker, Mr. Phil Ritzenthaler, of the Plating Engineering Company, Milwaukee, Wis., who explained the many engineering aspects of plating for other than decorative and anti-corrosive purposes and electroforming. He discussed nickel, copper, chromium, tin and lead from the standpoints of their adhesion, porosity, and lubricating qualities. Samples and photographs were displayed which proved very interesting. A discussion dealing with engineering problems followed.

Dinner attendance was 31, meeting attendance, 39.

Kenneth Kieselburg,
Secretary-Treasurer

SAGINAW VALLEY BRANCH

Forty-six members and guests attended the regular monthly meeting on October 10.

The guest speaker was Mr. Douglas Thomas, of General Motors Research, who dealt with G-M acid-copper, internal stress, and white-brass plating. Slides showed various views of internal-stress measurements.

Not less than 12 new members were elected. Dean Botts was the winner of the door prize furnished by Willis Stoddard of the Pennsylvania Salt Mfg. Co.

Entertaining movies were shown following the dinner.

Eldon A. Brisson,
Recording Secretary

ST. JOSEPH VALLEY BRANCH

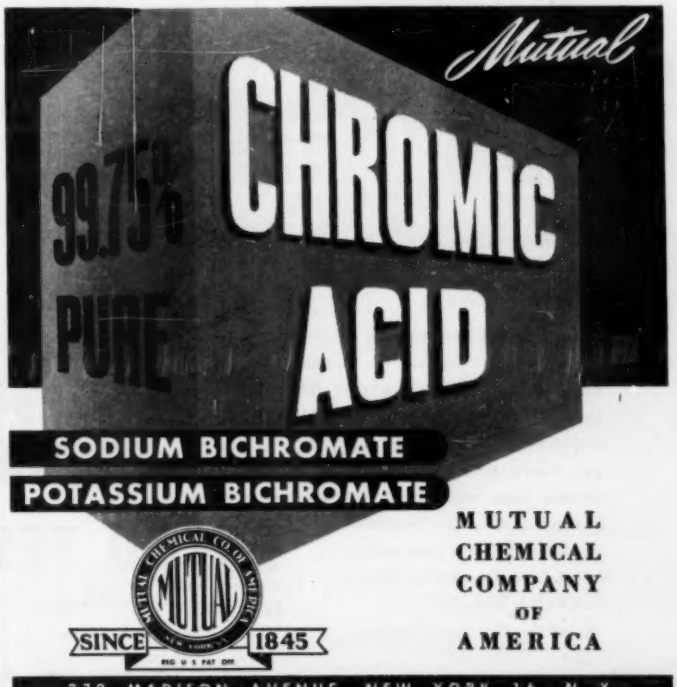
The regular monthly meeting at the Hotel Elkhart, Elkhart, Ind., on October 3 was the first meeting of the Fall season. We had an exceptionally fine turnout; 29 members and guests attended the dinner, and 49, the technical session.

President Dr. Ernest Wilhelm introduced the chairman of the Membership Committee, Richard C. Lockerbie, and requested the members to assist him in bringing delinquent members back into the Branch. Dr. Wilhelm also introduced the Branch Research Chairman, William S. McDowell, and asked for the cooperation of all members in the solicitation of sustaining members.

Five guests were introduced, and two applications for membership were submitted.

Librarian John Bayman introduced the honored guest speaker, Mr. W. J. Neill, Past President of the A. E. S. Mr. Neill first discussed the aims and plans of the A. E. S., including a meeting of Delegates to be held at Philadelphia on February 9, 1952; the need for reconsideration of the membership dues, because it is not felt that Plating should consistently be forced to make up the deficit of the Society's operations; and the 1952 Chicago Finishing Exposition, which should be successful both as a show and as a solution to the Society's financial problems.

Mr. Neill then discussed "Problems of Electroforming and Electropolishing". Nonconductors are now being plated rather successfully by the deposition of copper on top of 4–7 coats of lacquer and the usual bronze powder. It is essential to apply low current densities until the parts have been completely bridged over: approx. 2 asf during the first 3 minutes, 10 asf during the next 5 minutes, 12 asf during the next 15 minutes and 50–60 asf after the first hour. A total of 0.020–0.050 inch of copper can be deposited in approximately 4 hours. In this work, electropolishing is being used



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almost entirely after plating. After this, the parts are oxidized and wiped off with a light color buff.

After his talk Mr. Neill answered many questions from the floor particularly about the composition of the various baths used in electropolishing and their advantages and disadvantages. He also mentioned the "Manual on Waste Control", published by the Ohio River Water Commission at 414 Walnut Street, Cincinnati, Ohio.

The Branch is very grateful to Mr. Neill for his very informative discussion, both of the Society and his technical subject, as well as for his delightful description of the puzzling problems confronting the occupant of the modern roomette under the stress of everyday emergencies.

EUGENE ROTH,
Secretary-Treasurer

ST. LOUIS BRANCH

The first meeting after the summer months was held on October 10 in The York Hotel. PRESIDENT ROBERT called the members to order, and then asked each one to introduce himself.

Before the officers gave their reports, VICE-PRESIDENT JULIUS presented the President with an engraved gavel. The financial report for the year was given. All were told of the tentative program for the year and that all committees would be appointed by the next meeting.

LIBRARIAN WRISBERG introduced MR. H. C. IRVIN of Allied Research Products, Inc., as the speaker of the evening. His subject was "Chromate Finishes in War and Peace".

After the meeting, all enjoyed watching the fight over the television while refreshments were served.

ED HUNLETH, *Secretary*

SAN FRANCISCO BRANCH

The meeting on July 19 was held in Alameda, Calif., at Tim's Restaurant, with 27 members attending. It began with a social hour, after which dinner was served. Entertainment and drinks were provided by the shop owners.

Following a business meeting, MR. FRED HUNTINGTON, San Francisco Bay Area Consultant, gave a very interesting talk on solution maintenance, covering such subjects as maintenance of solution level and methods of making tank additions.

The membership extends thanks to S. PANKEY, who arranged the Alameda meeting, and MR. ALEXANDER, who contacted the shop owners, and made arrangements for cocktails, table wine, and after-dinner drinks. The meeting was a real success, and it was suggested that another of the same type be held in the future, with another group footing the bill for drinks and entertainment.

HORACE J. SMITH, *Secretary-Treasurer*

SAN FRANCISCO BRANCH

A social hour at 6:00 P. M. and a dinner hour at 7:00 preceded the meeting on August 16 in St. Julien's Restaurant.

Two new members were elected.

FIRST VICE-PRESIDENT STUART PANKEY, who presided, opened the round-table discussion on "Brass Plating", during which each member made comments. The concensus was that for most decorative purposes brass plating should be carried out in a conventional bath for 1–5 minutes with a current density of 5 asf, and the thickness should be previously built up in a high-speed cooper. One or two members put forth ideas on using high-speed brass solutions, with only a copper strike and brass plating to build up the thickness, still maintaining the color. The comments of the members were taken down, and a copy of the digest is available to anyone who desires it.

HORACE J. SMITH, *Secretary-Treasurer*

SAN FRANCISCO BRANCH

Two committees were appointed at the meeting on September 20 in the El Curtola Restaurant, Oakland. The Membership and Attendance Committee includes STUART PANKEY, Chairman; FRED HUNTINGTON, FRED LANE, GEORGE COOK, MARK CROW and HORACE SMITH; the Christmas Committee, EDWARD MOON, Chairman; CLARENCE OWENS, JEFF DAVIS.

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Are you finishing articles which require a wheel with a "shaped" or contoured face? Don't forget that felt wheels lend themselves to contouring probably better than any other type of wheel. Don't forget, too, you have nine degrees of hardness to choose from when you buy Bacon Felt Wheels—The Paramount Brand. Ask your supply house for Paramount Brand Felt Polish Wheels.

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Your Supply House can Furnish Bacon PARAMOUNT BRAND FELT BOBS & WHEELS

New hours for future meetings are: Social Hour, 6:45–7:15; Dinner, 7:15–8:15; Meeting, 8:15 P. M.

Four educational sessions, with entertainment and cocktails provided by four alternating groups, are planned for each year. A number of subjects for the sessions were suggested, and will be kept on a permanent list. "How to Strip Coatings Prior to Recleaning and Replating" will be the subject for October, presented by STUART PANKEY.

HORACE J. SMITH, *Secretary-Treasurer*

SOUTHEASTERN BRANCH

Sixteen members and guests were present at the meeting on September 14 in Georgian Hotel.

It was agreed to hold an educational meeting, and it was suggested that it include not only a technical program but also dinner and dancing. It was decided that dues for student members should be $3.00 per year. One member resigned.

W. F. KELLY told about some recent experiences his company has had with polyethylene flame spraying.

E. P. COFIELD requested that information be turned over to him as soon as possible so that he might begin writing the history of the Branch.

FRED W. COX, *Secretary*

SOUTHEASTERN BRANCH

The meeting on October 12 held at the Georgian Hotel was opened at 8:30 by PRESIDENT WEYMOUTH. Fourteen members and guests were present. One new member was introduced.

The guest speaker, DR. R. S. INGOLS, Research Professor at Georgia Tech., spoke on "Industrial Wastes and Stream Pollution" as they pertain to electroplaters.

FRED W. COX, *Secretary*

SPRINGFIELD BRANCH

Thirty-five members and guests were present at the October dinner and meeting held at the Hotel Charles. Attendance at the monthly meetings has shown remarkable improvement this year since the adoption of dinner meetings at $1.50 per member. Any expenditure over this figure is being paid out of a fund contributed by member suppliers.

LIBRARIAN HEROUX introduced the speaker, MR. ARTHUR ZAVARELLA, Materials Engineer in the Research Branch of the Springfield Armory. Speaking about "Specification Requirements and Test Methods for Ordnance Finishes", he first gave a resumé of the different finishes being used by the Ordnance Department and reasons therefor. Next, he briefly outlined the test methods used and how they are chosen. After the discussion period, various testing equipment was shown, with members of the Springfield Armory Laboratory operating the equipment and answering questions.

E. F. KOETSCH, JR., *Secretary*

SYDNEY BRANCH

The 77th regular meeting was held on October 11 in the Trust Building, King and Castlereagh Streets.

MR. R. FACER, of Efco Pty Ltd., one of the leading diecasters, gave an interesting talk on zinc diecasting and plating of the castings. He then entertained the members by screening a long film on the manufacture of diecastings. The members gained an insight into an industry not new in U. S. A., but relatively new in Australia.

This film was followed by other educational and entertaining films, and a vote of thanks was passed to Mr. Facer for an interesting evening.

W. W. PATERSON,
Secretary-Treasurer

SYRACUSE BRANCH

The first meeting of the 1951–1952 season, held in Herkimer, N. Y., 65 miles from the Branch's home base, took on the aspects of a National convention. About 75 men sat down in the Prospect Hotel to a splendid dinner, interspersed with some fine amateur entertainment provided through the generosity of the H. M. Quackenbush Company of Herkimer, whose president is a member of the Syracuse Branch.

We were happy to welcome members from the Buffalo, Bridgeport, Providence, Waterbury and Newark Branches to hear the one and only B. G. Daw, Chairman of the Board of Lasalco, Inc., St. Louis, Mo., who seems to know considerable about barrel plating. His movies of tumbling parts in barrels were very interesting.

Some of the clan visited the Quackenbush plant and saw that much barrel plating was done there, and as the plater (Geo. Simmons) points out very emphatically, to specifications.

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Properties of **UNICHROME COATING 218X** *pay off once again—reducing hard chromium plating time*

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MR. CHARLES FAY, the town clerk of Herkimer, gave everyone an official welcome. MEMBER DANIEL GRAY, Chief Chemist of Oneida Ltd., was on hand with one of his uproarious talks. The members who live in the beautiful Mohawk Valley saw to it that everyone had a good time and gained knowledge of help in our complex industry. Thanks go to GEORGE SIMMONS, his committee, and H. M. Quackenbush Company.

LINDLEY S. WOOD, *Secretary*

SYRACUSE BRANCH

The October meeting was held at the Loyal Order of Moose Hall, with forty members and guests attending. A Dutch-treat ham dinner was served some 33 members before the meeting.

PRESIDENT HANK HOLBERT opened the meeting and presented one new membership application. The speaker of the evening, MR. S. A. FABRY, Chief Rack Designer of the Belke Manufacturing Company, Chicago, Ill., was introduced by LIBRARIAN DON MORRIS. Mr. Fabry presented a very interesting paper on "Plating Racks and Racking", and answered many questions on the subject. MR. BRUCE BELKE gave each of the members a handy auto-key case.

A motion picture, "Fishing", shown through the courtesy of Stewart Nash Corporation, Syracuse, N. Y., proved that not all big "ones" get away.

Refreshments were served through the courtesy of the Frederick Gumm Chemical Company, Inc., Kearny, N. J., with ED HOLLISTER acting as host.

LINDLEY S. WOOD, *Secretary*

TORONTO BRANCH

After a two month recess, the Branch opened its Fall season on September 14 at the Royal York Hotel.

The speaker was MR. A. HARRIS, of the Detrex Corporation, Detroit, whos subject was "Phosphate Coatings and Their Uses in Fabricating Steel Stampings". Mr. Harris gave a complete history of phosphate coatings, from the original discovery to the present day. Phosphate coatings, with the aid of a lubricant, are now being used to make deep draws that were previously considered impossible. They also promote a much longer die life. It was a very interesting presentation, much enjoyed by the members.

A short business meeting followed, at which five new members were admitted to the Branch.

A. L. COXHEAD, *Correspondent*

TWIN CITY BRANCH

The Branch met on October 1, in the Lodge Room of the Covered Wagon in Minneapolis, with twenty-three persons present.

Following dinner, Retiring President AL JOYNER introduced the guests and summarized the activities of the Branch during the past year. He emphasized the successful Annual Party, and thanked the members of the Board of Managers as well as the Committee Chairman. Mr. Joyner was given a rising vote of thanks for his fine leadership during the past year.

The new President, WRAY SCHORR, spoke briefly about the need for new members and increased attendance, and announced that the Board of Managers had presented the Secretary with a check for $50.00 as a token payment for the services he rendered during the past two years.

LIBRARIAN GEORGE C. REED introduced the speaker, MR. R. M. MACINTOSH, of the Tin Research Institute, who spoke about "Tin and Tin-Alloy Plating" and showed slides that were both informative and interesting. Following Mr. MacIntosh's talk, several questions were raised from the floor.

ROBERT L. BUCKLEY, *Secretary*

WATERBURY BRANCH

At the regular monthly meeting held in Hotel Elton on September 14 PAST PRESIDENT DAVID MAITLAND reviewed activities of the Branch during his term of office.

VICE-PRESIDENT E. V. COLLINS presented a summary of membership changes, and recalled the passing of FRED BALL and NORMAN TICE, both of whom were loyal members of the Branch for many years.

A financial report was rendered by SECRETARY SPENCER L. HENN, and DELEGATE E. T. CANDEE reviewed the business transactions at the Buffalo Convention.

"Crimes of Carelessness", a short movie portraying the human errors which so often cause serious fires, was shown, after which MR. F. P. O. POTTER, who super-

(*Continued on page 1297*)

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Membership Report of the A. E. S.

Elections

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BRIDGEPORT: A. L. Perkins, R. L. Onkey, M. C. Tamas

CINCINNATI: D. L. Kaplan, R. A. Pfefferle, F. W. Schrimper

DALLAS-FORT WORTH: J. A. Lapham, H. E. Patterson, R. S. Sloan, Jr.

DAYTON: G. J. Mitchell, R. W. Seery

DETROIT: N. Goertz, H. W. Marx, N. R. Schmidt

GRAND RAPIDS: B. A. Britton

INDIANAPOLIS: F. G. Anderson, J. A. Marshall, W. F. Raymond, T. Wilhoite

MELBOURNE: W. M. Taylor, D. Walker

MILWAUKEE: J. H. Schneider, S. R. Taterzinski, J. F. Wright

NEW YORK: A. J. Abrams, N. Kuperschmid, D. Roberts

PITTSBURGH: N. D. Bulger, D. H. Justad

ST. LOUIS BRANCH: G. K. Fuerst, W. E. Brumwell, R. Rife

SAGINAW VALLEY: G. W. Cline, G. L. Gutcher, J. O. Lovelace, C. Marshan, W. A. Mason, D. L. Shepard, D. W. Smith, H. E. Van Buren

SAN FRANCISCO: P. A. DiMaria

SOUTHEASTERN: C. I. Lewis

SYDNEY: R. D. Stewart

SYRACUSE: P. Jankiewicz

MEMBERS-AT-LARGE: J. W. Cuthbertson, R. Teichmann, A. G. Ochoa

Reinstatements

DETROIT: S. E. Dolman, J. V. Downer, C. J. Finerty, G. P. Hogg, E. G. Schroeder

LOS ANGELES: L. Davis

PHILADELPHIA: J. J. DePasquale, R. D. DiStefano, W. J. Jondreau, D. K. Robson, L. Sherman, A. R. Wanamaker

SAN FRANCISCO: R. Karczynski

ST. LOUIS: M. Unterberger

SOUTHEASTERN: E. R. Hines, J. A. Toney

MEMBERS-AT-LARGE: H. J. Bache, J. v. d. Graaf

Transfers

R. M. Wick to Allentown-Reading; C. Murray from Dallas-Fort Worth; C. H. Castle to Grand Rapids; R. Twyning from Grand Rapids; E. B. Hunt from Grand Rapids; L. Glenn Hakes to Indianapolis; E. J. Quinlan from New

Membership Competition

BRANCH	Membership Apr. 1, 1951*	New Members	Net Change in Membership	Per Cent Net Change
First Group				
Melbourne	126	25	+19	+15.1
Chicago	409	32	+26½	+ 6.5
New York	279	17	+18	+ 6.4
Boston	151	7	+ 6	+ 4.0
Hartford	137	5	+ 2	+ 1.5
Bridgeport	152	9	+ 1½	+ 1.0
Waterbury	126	3	+ ½	+ 0.4
Milwaukee	143	9	.....	.....
Cleveland	205	14	− 3½	− 1.7
Newark	239	8	− 5	− 2.1
Detroit	492	24	−14½	− 2.9
Los Angeles	211	9	− 9	− 4.3
Grand Rapids†	164	1	−11½	− 7.0
Philadelphia	201	6	−15	− 7.5
Pittsburgh	132	5	−13½	−10.2
Second Group				
Rockford	67	8	+ 8½	+12.7
Buffalo	85	11	+10	+11.8
Indianapolis	92	7	+ 9	+ 9.8
Toronto	121	9	+ 8	+ 6.6
Syracuse	85	9	+ 3	+ 3.5
Baltimore-Washington	87	5	+ 2	+ 2.3
Rochester	88	2	+ 2	+ 2.3
Dayton	82	2	.....	.....
Cincinnati	88	4	− ½	− 0.6
Providence-Attleboro	100	..	− 1	− 1.0
Montreal‡	77	4	− 1	− 1.3
St. Louis	105	3	− 3	− 2.9
Sydney	93	3	− 6	− 6.5
St. Joseph Valley	71	1	− 8½	−12.0
New Haven	108	1	−20½	−19.0
Third Group				
Dallas-Fort Worth	31	14	+13½	+43.5
Houston	25	8	+ 9	+36.0
Saginaw Valley	57	12	+ 5½	+ 9.6
Louisville	23	1	+ 1	+ 4.4
Lancaster	60	2	+ 1	+ 1.7
San Francisco	65	5	+ 1	+ 1.5
Hamilton	25	..	.....	.....
Jackson-Lansing	52	1	− ½	− 1.0
Allentown-Reading§	42	2	− ½	− 1.2
Springfield	54	2	− 2	− 3.7
Twin City	66	1	− 2½	− 3.8
Southeastern	48	3	− 3	− 6.2
Toledo	45	..	− 4	− 8.9
Adelaide	65	5	− 7	−10.8
Columbus	54	2	− 7	−13.0
Western Ontario	23	4	− 6	−26.1
Outside Competition				
At Large	120	11	− 6	.....
In Transfer	16	..	+10	.....
Total A. E. S.	5,387	324	+ 5	+ 0.1
Active Membership, November 1, 1951			5,392	

*Subject to correction. †, ‡, §Winners in first, section and third group, respectively, of 1950–1951 membership competition.

Haven; J. M. Davidson to Philadelphia; W. J. Hennessey to Philadelphia; T. Laken from Rockford; R. Karczynski from San Francisco to Los Angeles; R. L. Nyquist to Waterbury

Resignations

BRIDGEPORT: L. E. Miller

GRAND RAPIDS: J. Maskal, J. W. Pulte, W. B. Rice, E. C. Westrick

NEW HAVEN: F. E. Bristol, M. B. Grandy

PITTSBURGH: R. S. Gracey

WATERBURY: W. Jaquiery

Suspensions

GRAND RAPIDS: A. R. Behl, W. E. Daughtery, H. F. Johnson, R. Link, A. J. Nook, C. Nuttall, J. Wickering

NEW HAVEN: H. M. Barnard, S. R. Bartek, C. A. Bridgett, H. J. Creamer, E. M. Desmond, L. Dicks, R. S. Gray, F. J. Gura, E. W. Luther, G. Macare, C. Mattee, W. L. Pailthorp, J. T. Pelzer, O. A. Stocker, J. Taylor, R. T. Williams, J. K. Willis

PITTSBURGH: E. T. Busch, J. E. Bird, A. H. Bauman, J. J. Carroll, R. T. Graf, J. E. Jones, J. F. Lohr, N. H. McKay, P. B. McCloskey, J. W. Nelson, A. F. Prust, W. H. Rolshouse, R. Speilvogel, J. C. Tanner, H. C. Woodsum, Sr., W. B. Williams

ST. LOUIS: J. Bailie, A. S. Burnett, L. Barkley, D. Finney, J. Marshall, K. Repp, A. Weller

SAGINAW VALLEY: C. A. Houle, F. O. Johnson, S. W. Lees, V. R. Nichols, R. R. Smith

Deaths

BRIDGEPORT: W. Thompson

NEW HAVEN: W. F. Bridgett, J. H. Chamberlain

NEW YORK: A. Bregman

MEMBER-AT-LARGE: A. W. Hothersall

Branch News

(*Continued from page 1295*)

vises engineering on fire risks, and the training of fire field men for the Automobile Insurance Company and the Standard Fire Insurance Company, presented a spectacular demonstration of a number of important causes of fires in home and in industry, at the same time illustrating precautions to be exercised to avert fires and explosions.

The meeting was brought to an extremely pleasant conclusion by a lunch of beer and sandwiches, served through the courtesy of MacDermid, Incorporated.

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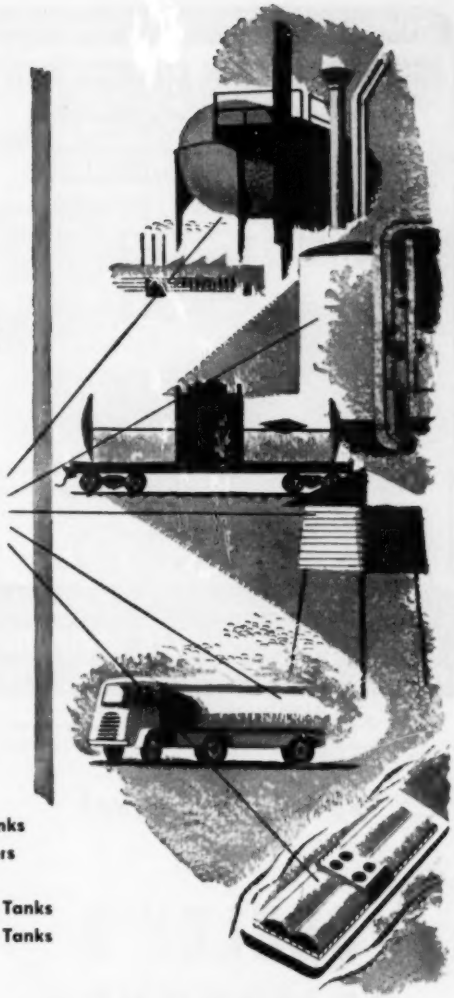

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Secretary.....The Executive Secretary

Chairman.....Dr. DONALD PRICE
Oakite Products, Inc.
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(Changes Only)

BRIDGEPORT meets second Friday of each month in Barnum Hotel. Secretary-Treasurer, Gerald B. Rice, 367 Granfield Avenue, Bridgeport 8, Conn. Research Finance Committee Chairman, Carl Schaefer, c/o Casco Products Corporation, 512 Hancock Avenue, Bridgeport 5, Conn.

DALLAS-FORT WORTH. Secretary, C. A. White, 715 W. Davis Street, Dallas 11, Texas.

MONTREAL meets first Tuesday of each month in Mount Royal Hotel. Secretary, L. A. Robillard, 3993 Lesage Street, Verdun 19, P. Q., Canada. Research Finance Committee Chairman, P. M. Coady, c/o Alloycraft, Ltd., 27 Hillside Avenue, Westmount, Montreal 6, P. Q., Canada.

PITTSBURGH meets second Thursday of each month in the Avon Room of Sheraton Hotel. Secretary, R. H. Schindler, 125 Fairfax Road, Forest Hills, Pittsburgh 21, Pa. Research Finance Committee Chairman, S. S. Johnston, c/o Weirton Steel Company, Weirton, W. Va.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence Engineering Society Hall, 195 Angell Street, Providence, R. I. Temporary Secretary, Dr. E. A. Parker, c/o Technic, Inc., 39 Snow Street, Providence 3, R. I. Research Finance Committee Chairman, Pierre B. Lonsbury, 78 North Avenue, Attleboro, Mass.

SAN FRANCISCO meets third Thursday of each month, alternating between St. Julien Restaurant, 140 Battery St., San Francisco, and El Curtola Restaurant, 510 17th St., Oakland. Secretary-Treasurer, Horace J. Smith, 319 Alta Loma Drive, South, San Francisco, Calif. Research Finance Committee Chairman, Alan Baker, 10 Bluxome St., San Francisco, Calif.

SYRACUSE meets third Monday of each month in Loyal Order of Moose Hall, 643 W. Onondaga Street. Secretary, Lindley Wood, 1329 Bellevue Avenue, Syracuse 4, N. Y. Research Finance Committee Chairman, George W. Cavanaugh, 129 Kenwood Avenue, Syracuse, N. Y.

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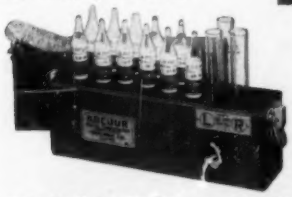

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30	22″	20″	29.50
35	21″	24″	30.50
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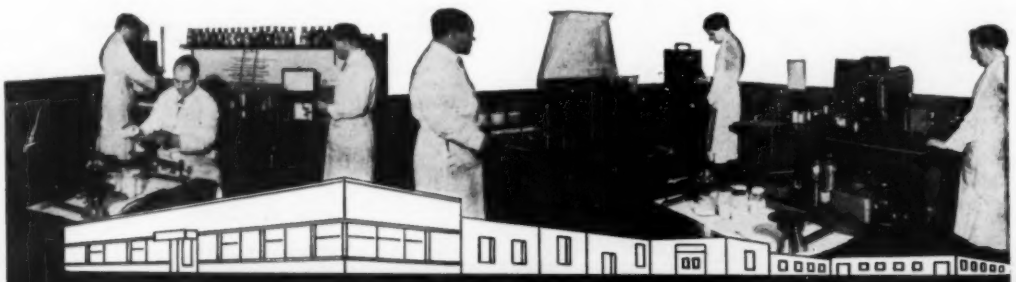

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BECKMAN INSTRUMENTS, INC. 1228
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Agency: Spooner & Kriegel
MAGNUSON PRODUCTS CORPORATION 1234
Agency: George Wilfred Wright
MEAKER COMPANY, THE 1233
Agency: The Advertising Corporation
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Agency: Elwood S. Allen Advertising
METAL & THERMIT CORPORATION 1270
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MINNESOTA MINING & MFG. COMPANY 1214
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Agency: Wehner Advertising Service
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OAKITE PRODUCTS, INC. 1273
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Agency: Tech-Industry Services

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Agency: Harold S. Card
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SULPHUR PRODUCTS COMPANY, INC. 1272

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Agency: Gallard Advertising Agency, Inc.
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Agency: Rickard and Company, Inc.
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A. S. T. M. SPRING MEETING AND COMMITTEE WEEK in Hotel Statler, Cleveland, Ohio, on March 3–7, 1952.

CHICAGO INTERNATIONAL TRADE FAIR on the Navy Pier, March 22–April 6, 1952.

THE ELECTROCHEMICAL SOCIETY'S 50TH ANNIVERSARY MEETING in Benjamin Franklin Hotel, Philadelphia, Pa., on May 4–8, 1952.

3RD INDUSTRIAL FINISHING EXPOSITION AND 39TH ANNUAL CONVENTION OF THE AMERICAN ELECTROPLATERS' SOCIETY in International Amphitheatre, Chicago, on June 16–20, 1952.

A. S. T. M. 50TH ANNUAL MEETING in Hotels Statler and New Yorker, New York City, on June 23–27, 1952.

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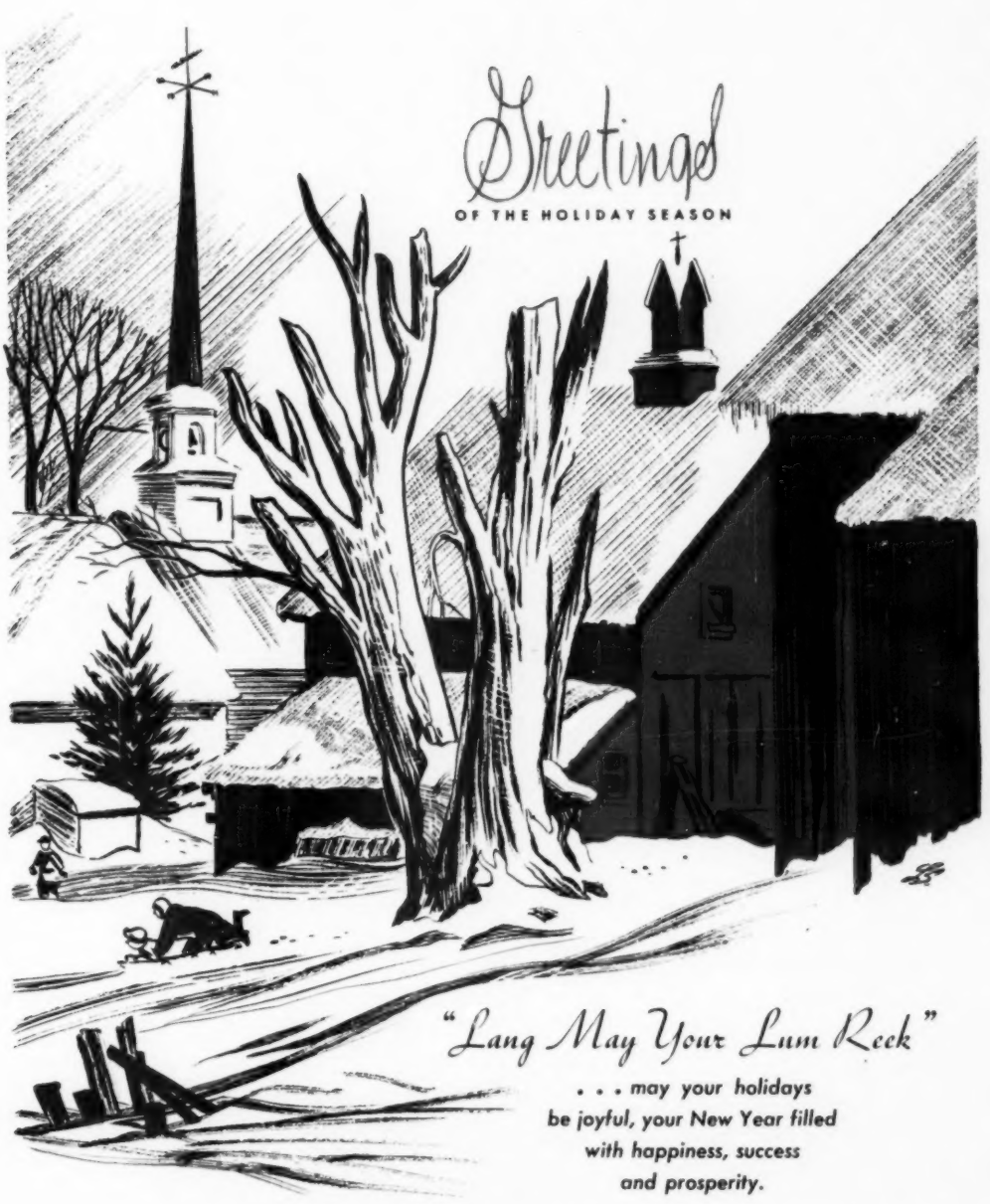

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